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Cornhusker Army Ammunition Plant GEOTECHNICAL REPORT

ENVIRODYNE ENGINEERS, INC.

12161 Lackland Road

St. Louis, MO 63141

30 March 1982

Interim Report Number 2

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) On September 15, 1981, Envirodyne Engineers, Inc. (EEI) was contracted by Mason and Hanger-Silas Mason Company to conduct a preliminary contamination survey of the Cornhusker Army Ammunition Plant (CAAP). As part of this survey, 33 groundwater monitoring wells were installed at the CAAP. These wells were used to determine the water table configuration, groundwater flow directions, and estimated groundwater flow velocities. The general near surface geology and groundwater flow system are fairly simple. The water table			

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aquifer is a poorly graded sand, and the water table has a uniform, gentle slope to the northeast. Several potential sources of groundwater contamination have been previously identified. There are now monitoring wells at all of these sites. Based on the soil descriptions and water table configuration, some of the wells at most of the sites may intersect the potential groundwater contaminant plumes. The uncertainty lies in the estimates of lateral dispersivity and horizontal soil permeability.

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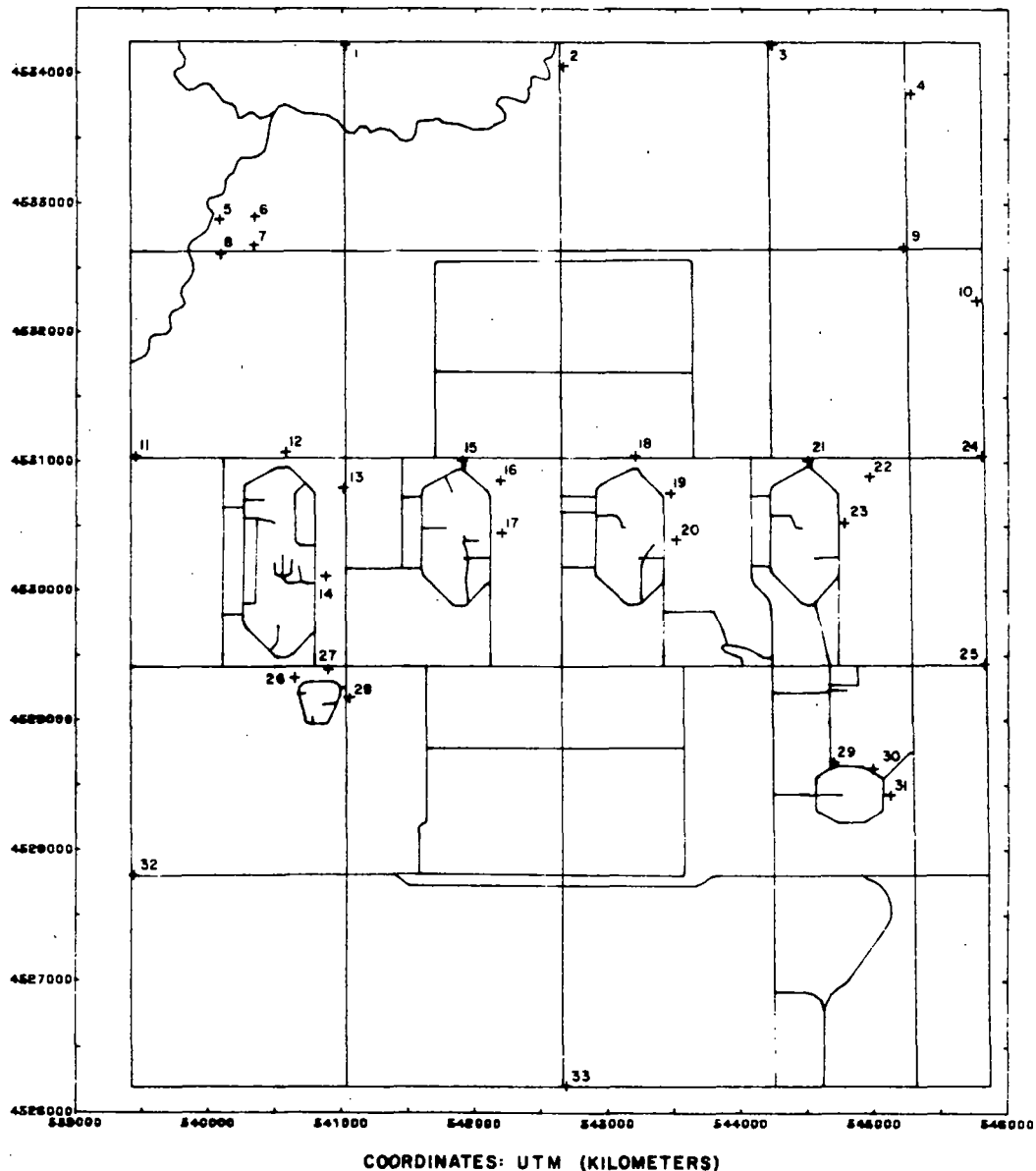
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CHAPTER 1

INTRODUCTION

On September 15, 1981, Envirodyne Engineers, Inc. (EEI) was contracted by Mason & Hanger - Silas Mason Company, Inc. to conduct a preliminary contamination survey of the Cornhusker Army Ammunition Plant (CAAP). As part of this contamination survey, EEI was directed to install 33 groundwater monitoring wells at CAAP (Figure 1-1). These wells were installed by Southwestern Laboratories, Inc. (SWL) as EEI's subcontractor. The completed wells were approved by Mason & Hanger - Silas Mason Company personnel on December 9, 1981.



MONITORING WELL LOCATIONS

FIGURE I-1

CHAPTER 2

FIELD INVESTIGATIONS

WELL DRILLING AND INSTALLATION

The borings were advanced using hollow stem augers (HSA), 6-inch I.D. (nominal). Split spoon samples were collected at 5-foot intervals or at major changes in lithology as shown on the boring logs (included as Appendix A). The soils encountered were described and visually classified in the field. These descriptions and classifications are shown on the logs in Appendix A.

During drilling and sampling the "first encountered water" depth was noted, and the boring advanced approximately 18 to 20 feet deeper than that point. The HSA with the center plug still in place was then backed out approximately 3 to 5 feet. This helped to prevent the soils from heaving up inside the hollow stem when the plug was removed.

Once the plug was removed, the 4-inch diameter well screen and pipe were placed inside the hollow stem of the auger. The sand backfill and bentonite seal (see Appendix B) were then emplaced as the augers were backed out of the hole from around the well. The cement grout was emplaced above the bentonite seal to approximately 3 feet from the ground surface. Several days later, the steel protector pipe (see Appendix B) and four metal posts were installed.

The well screens were each 15 feet long and made of Schedule 40 PVC. All screens were commercially slotted with 0.010 inch wide slots. The well pipe consists of Schedule 40 PVC pipe with bell-end couplings. The couplings were solvent welded as the screens and pipe were installed. Very fine to fine Mason's sand was used as backfill material around the well screens. Bentonite pellets were used to create the bentonite seal. The grout was a cement/bentonite mix with a weight ratio of 6:1, cement:bentonite.

The steel protector pipes were fabricated out of Schedule 40 iron pipe with a hinged, locking lid. The lids were made out of steel plates. The pipes were each 5 feet long, and the bottoms of the pipes were set between 2.0 and 2.5 feet below grade. The pipes were cemented into place. Four 3-inch metal posts were placed around each well. The posts were painted orange. The well numbers were painted on the steel pipes and stamped onto brass tags which were wired to the pipes. Table 2-1 summarizes some of the well construction data.

TABLE 2-1
WELL CONSTRUCTION DATA

Well No.	Well Depth From Ground Surface (ft)	Top of Casing (TOC) Elevation (ft)	Height of PVC Stick-Up Above Ground (ft)
G1	30.09	1902.53	2.83
G2	36.33	1899.29	2.75
G3	26.71	1893.92	2.75
G4	32.41	1892.55	2.92
G5	28.04	1906.52	2.75
G6	27.00	1903.45	2.92
G7	27.00	1904.45	2.92
G8	33.42	1906.32	2.75
G9	28.83	1894.21	2.67
G10	27.66	1891.32	2.92
G11	28.58	1912.81	2.67
G12	28.54	1911.86	2.71
G13	33.50	1912.03	2.50
G14	32.25	1915.39	2.92
G15	32.42	1910.35	2.58
G16	29.50	1910.64	2.50
G17	31.29	1910.57	2.67
G18	33.25	1906.26	2.75
G19	33.33	1906.39	2.50
G20	31.92	1908.38	2.83
G21	33.58	1900.49	2.75
G22	32.44	1899.18	2.81
G23	33.29	1901.67	2.67
G24	30.66	1896.00	2.67
G25	32.83	1900.54	2.75
G26	38.12	1920.22	2.67
G27	38.09	1920.31	2.83
G28	36.83	1918.35	2.75
G29	33.84	1907.56	2.66
G30	31.96	1907.27	2.67
G31	33.08	1904.43	2.75
G32	42.67	1931.12	2.75
G33	33.50	1917.40	2.67

Between each boring, the drilling rig and ancillary equipment were washed off using water from the CAAP water supply system.

WELL DEVELOPMENT

The wells were developed using a 4-inch diameter submersible pump. At least ten times the volume of standing water existing in the 11-inch auger hole was removed from the well. Almost all of the wells produced clear water at the end of development. The few wells, which did not produce clean water, produced water containing a yellowish-brown tint probably due to suspended clay particles. The records documenting well development are included as Appendix C.

PROBLEMS AND SOLUTIONS

Few problems were encountered during the installation of the wells. Poor weather conditions hampered well drilling for approximately one week. Two wells (G-29 and G-2) were initially unacceptable and were redrilled, each within 5 to 10 feet of the abandoned well. As the augers were being backed out of the initial hole at Well G-29, the well casing and screen came partially out of the hole (approximately 8 feet) along with the augers. The well installation was then completed and the water level allowed to stabilize. The water level was measured, and the decision was then made to redrill the well due to insufficient water in the well.

Well G-2 produced a very low yield during development. This well was redrilled and the new well produced a high yield. The two abandoned wells were not grouted inside the PVC pipe nor were protective casings or posts placed around them.

Problems were also encountered with the survey data for the well locations. The coordinates of the wells appeared to plot correctly on a USGS topographic map, but when these coordinates were entered into the data management system and plotted via computer, there appeared to be an error. The error appeared to be a translational error (rather than rotational), with the well locations all appearing to plot correctly relative to each other, but shifted to the northeast relative to roads and other landmarks. Rather than redigitize the base map, USATHAMA decided to digitize the well locations so that they plot correctly via computer. It is assumed that the originally surveyed coordinates are correct. Therefore, for all manually drawn figures, the surveyed coordinates were used (Table 2-2). For all computer generated figures, the digitized coordinates (Table 2-3) were used.

TABLE 2-2
SURVEYED MONITORING WELL ELEVATIONS AND COORDINATES

<u>Well No.</u>	<u>Elevation (Top of Casing) (ft)</u>	<u>State Plane Northing (ft)</u>	<u>Coordinates Easting (ft)</u>
G1	1902.53	472,742.41	2,272,940.51
G2	1899.29	472,355.11	2,278,260.45
G3	1893.92	472,894.24	2,283,433.85
G4	1892.55	471,685.43	2,286,913.16
G5	1906.52	468,369.60	2,269,854.97
G6	1903.45	468,400.88	2,270,738.50
G7	1904.45	467,666.56	2,270,753.23
G8	1906.32	467,522.32	2,269,800.05
G9	1894.21	467,801.23	2,286,839.67
G10	1891.32	466,482.84	2,288,800.36
G11	1912.81	462,360.56	2,267,837.61
G12	1911.86	462,438.00	2,271,536.93
G13	1912.03	461,571.91	2,272,977.58
G14	1915.39	459,307.89	2,272,585.57
G15	1910.35	462,271.91	2,275,905.67
G16	1910.64	461,762.59	2,276,884.58
G17	1910.57	460,437.58	2,276,905.06
G18	1906.26	462,421.44	2,280,200.40
G19	1906.39	461,499.15	2,281,090.29
G20	1908.38	460,332.63	2,281,165.89
G21	1900.49	462,344.23	2,284,512.59
G22	1899.18	461,925.33	2,286,004.67
G23	1901.67	460,705.33	2,285,358.08
G24	1896.00	462,548.16	2,288,854.45
G25	1900.54	457,269.88	2,288,848.38
G26	1920.22	456,807.05	2,271,817.64
G27	1920.31	456,980.89	2,272,621.88
G28	1918.35	456,303.13	2,273,186.23
G29	1907.56	454,603.17	2,285,147.41
G30	1907.27	454,549.30	2,286,125.94
G31	1904.43	453,918.15	2,286,642.33
G32	1931.12	451,688.80	2,267,934.95
G33	1917.40	446,538.77	2,278,522.25

¹ Surveyed in feet

² Computer in meters

TABLE 2-3
COMPUTER DIGITIZED MONITORING
WELL COORDINATES

UTM Coordinates

<u>Well Number</u>	<u>Easting (meters)</u>	<u>Northing (meters)</u>
G1	541027	453218
G2	542661	4534056
G3	544223	4534221
G4	545265	4533848
G5	540078	4532875
G6	540341	4532899
G7	540337	4532679
G8	540088	4532611
G9	545215	4532670
G10	545765	4532255
G11	539449	4531041
G12	540579	4531072
G13	541012	4530798
G14	540882	4530109
G15	541903	4531007
G16	542190	4530858
G17	542197	4530446
G18	543200	4531049
G19	543467	4530760
G20	543506	4530396
G21	544498	4531016
G22	544962	4530892
G23	544767	4530527
G24	545804	4531052
G25	545825	4529441
G26	540650	4529329
G27	540900	4529394
G28	541060	4529177
G29	544690	4528675
G30	544986	4528628
G31	545117	4528428
G32	539440	4527805
G33	542689	4526212

CHAPTER 3

GENERAL ENVIRONMENTAL SETTING

The following was included as Appendix A of the specifications, and is reproduced here for reference purposes.

METEOROLOGICAL DATA

CAAP is located in Hall County, Nebraska, which has a continental climate, marked by light rainfall, low humidity, hot summers, and severe winters. The growing season is 160 days. The mean date for the first killing frost is October 6, and the last killing frost is April 29. The temperature and precipitation for Hall County over a 40-year period are summarized as follows:

Temperature, degrees Celsius (°C)		Yearly Precipitation, centimeters
January average	-4.4°C	Average 55.9
January minimum	-36.4°C	Minimum 30.5
July average	25.6°C	Maximum 116.5
July maximum	45.0°C	Average Snowfall 68.6

PHYSIOGRAPHY-TOPOGRAPHY-DRAINAGE

CAAP is located in Hall County, 6.4 kilometers west of the city of Grand Island, Nebraska. Hall County lies near the eastern margin of the Great Plains. Generally, the area is nearly level to gently undulating.

The Platte River Valley crosses the county in a southwest to northeast direction. CAAP lies within the valley approximately 8 kilometers north of the Platte River.

CAAP is underlain by moderately to highly permeable, unconsolidated deposits from the Quaternary age. Approximately 1.5 meters to 12 meters of Peorian loess (windblown silt deposit) top the section. Below the loess, there exist 15 meters to 30 meters of Pleistocene sand and gravel, below which are 15 meters to 37 meters of silt and clay. These unconsolidated deposits of Quaternary age rest upon semiconsolidated sediments of Tertiary age. These sediments belong to the Ogallala Formation and consist of sand and gravel deposited by streams from the west, and silt and clay laid down partly by wind and partly by water. Figure 3-1 depicts geological sections across Hall County. The section entitled "North-South Geologic Section Through the Center of Hall County" includes CAAP.

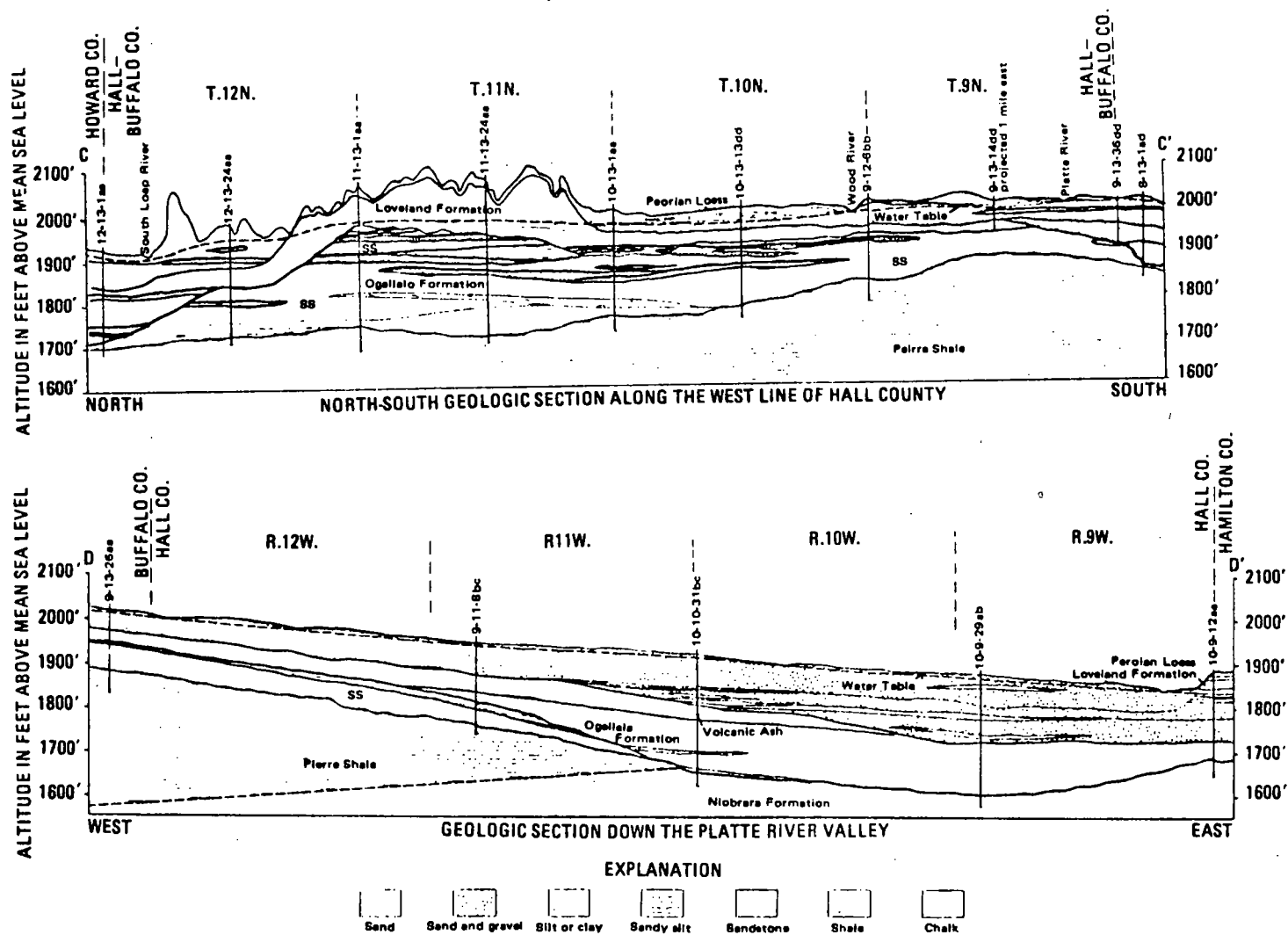


Figure 3-1 Geologic Sections Across Hall County, Nebraska (Sheet 1 of 2)

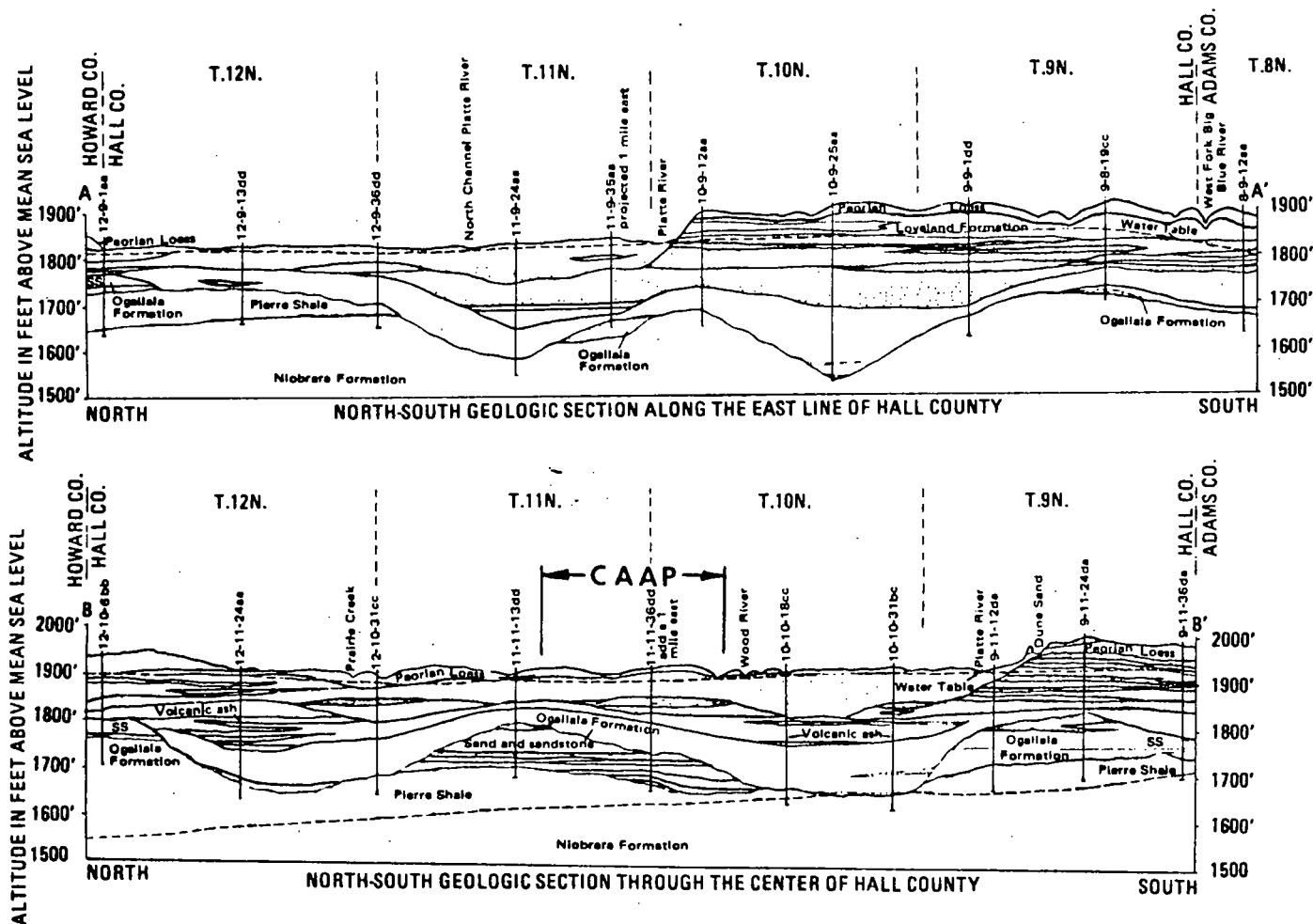


Figure 3-1. Geologic Sections Across Hall County, Nebraska (Sheet 2 of 2)

The bedrock surfaces on which the Tertiary and Quaternary deposits rest are primarily Pierre Shale of Late Cretaceous age. The bedrock under CAAP dips gently northward and is of marine origin.

At CAAP, surface drainage is via Silver Creek, two man-made drainage ditches (East and West Drainage Channels) constructed in 1973, and an old ditch (Railroad Ditch) which parallels the railroad tracks on the eastern boundary of the installation. All three ditches eventually discharge drainage waters into Silver Creek. The West Drainage Channel runs in a north-south direction, west of the North and South Storage Magazines and between Load Lines 3 and 4. The East Drainage Channel runs in a north-south direction, east of the North and South Storage Magazines between Load Lines 1 and 2. All surface waters on the installation ultimately drain into one of the drainage ditches or directly into Silver Creek. Figure 3-2 shows the surface drainage at CAAP.

The principal source of surface water in Hall County is the Platte River. Since the completion of Kingsley Dam in Keith County (west of Hall County), the Platte River is normally dry in summer. Other streams in the county, including Silver Creek which traverses the northern boundary of CAAP, are intermittent in nature and generally dry for most of the year, except after flash rains.

The supply of groundwater in the county is obtained primarily in Pleistocene (Quaternary) sands and gravels, which vary in thickness. The thickness of sand and gravel deposits generally increase as the deposits extend from the western side of the county to the eastern side. Figure 3-3 is a map of groundwater in Hall County. At CAAP, the thickness of water saturated sand and gravel is between 15 meters and 30 meters. Southeast of Grand Island, the water-bearing sand and gravel formation is more than 45.7 meters thick. The water-bearing sand and gravel throughout much of Hall County is 15 meters or more in thickness.

Some of the irrigation wells can discharge more than 3,785 liters per minute. Wells drilled at CAAP indicate that the sands and gravels vary from 1.8 meters to 2.5 meters below the surface to over 18 meters to 21 meters.

The coarse underground sediments in Hall County yield large quantities of good-quality water for industrial, household, and agricultural use. The groundwater is recharged, or resupplied, by stream flow of the Platte River and its tributaries, local precipitation, underground movement of water, and seepage of irrigation water. Local precipitation contributes the largest amount. Most recharge of groundwater from streams takes place in spring and fall after the streams have been dry during the summer.

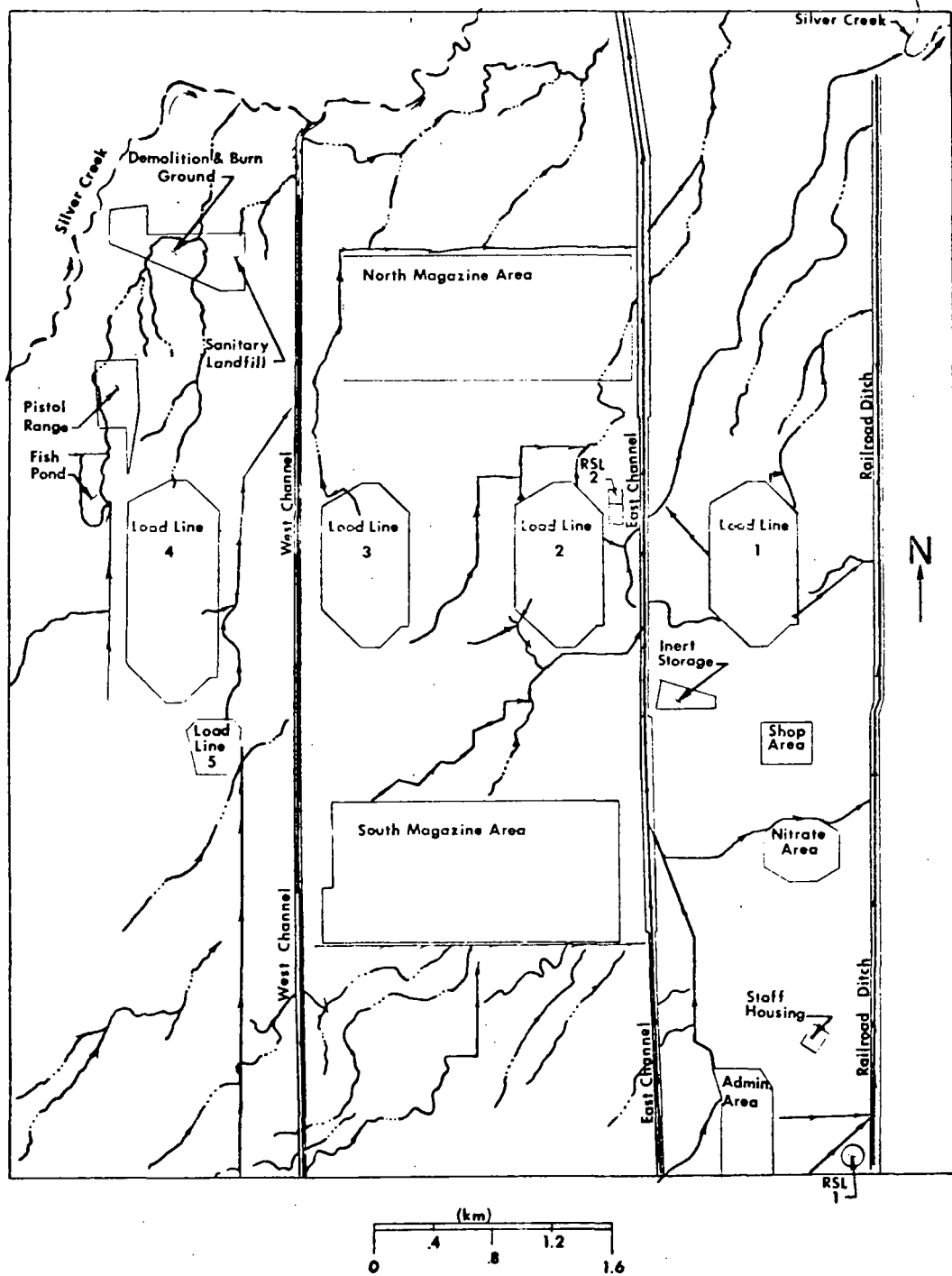
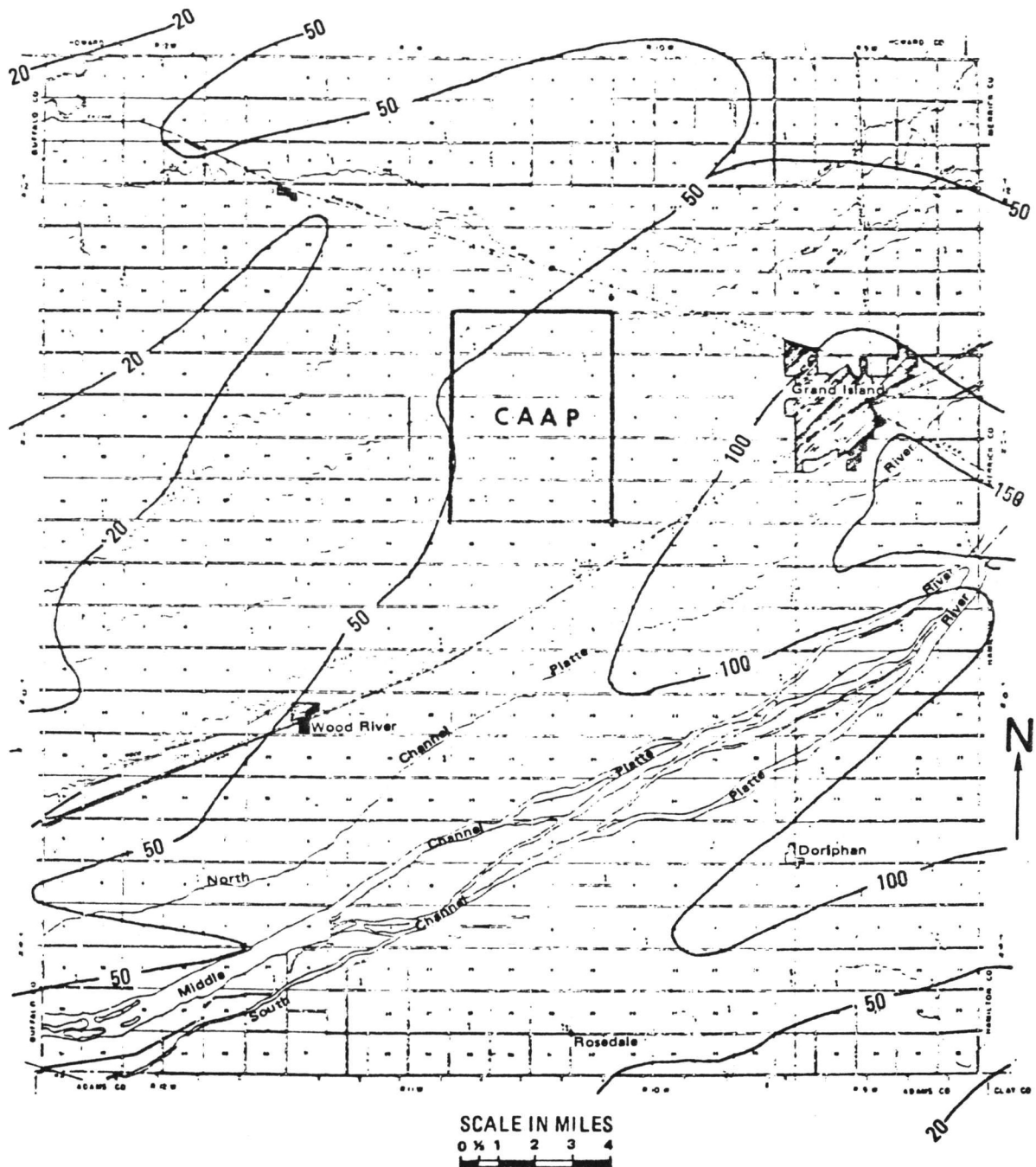


Figure 3-2. Surface Drainage at CAAP



Ground water map, Hall County, Nebr. Numbers in heavy lines designate, in feet, the effective thickness of water-saturated sand gravel. Four feet of sand is evaluated as effective as 1 foot of sand and gravel. The 50-foot line designates equal effective thickness of water-saturated sand and gravel in Pleistocene mantle rock. Map does not show the possibility of deeper effective thickness in Ogallala bedrock that may exist in the southwestern part of Hall County.

Figure 3-3. Groundwater in Hall County

The general movement of groundwater in the Platte River Valley is to the northeast, parallel to the Platte River (Figure 3-4). The underground water does not move more than 3.0 meters per day. In the extreme southeastern part of the county, the groundwater moves in a southeasterly direction.

The depth to the groundwater (water table) varies considerably. Along the bottom lands, and in some imperfectly drained areas of the terraces, it is at depths of less than 3 meters. In parts of the loessal uplands, it is below 47 meters. The static water level in the wells is between 4.7 meters and 7.6 meters.

The water table fluctuates in relation to the recharge and discharge of groundwater. Small changes in the depth to the water table take place daily in summer, but large fluctuations occur seasonally. The water table is generally lowest late in the summer after large amounts of water have been removed by irrigation wells and by the evaporation-transpiration of plants. During winter and spring, the water table is at its highest yearly level. There are also large fluctuations associated with wet and dry weather cycles.

The quality of groundwater in the county is good, although the water is moderately hard. There are normally from 200 to 600 parts per million (ppm) dissolved solids. Calcium and bicarbonate are the dominant constituents, and the amounts of iron and manganese are generally small. Nitrate concentrations are also high and range from several ppm to over 15 ppm. The nitrates are attributed to fertilizer usage in a heavy agricultural area. The temperature of the groundwater varies from 11.7°C to 12.7°C.

SOILS

The soils at CAAP vary from silty loam to sand loam. The principal soils are Wood River and Exline loams with small amounts of Ortello sandy loams, O'Neill loams, and Hord silty loams.

Wood River Series

The Wood River series consists mainly of deep, nearly level soils on stream terraces. It has a dark, thick silt loam surface horizon over a prismatic-blocky claypan subsoil. The most extensive areas are in the west-central part of the county, but some are on side slopes along shallow, intermittent drains where erosion is moderate. The soils formed on the high stream terraces are yellowish, wind-deposited silts; and the soils on the lower terraces north of Grand Island are mixed alluvium and loess, underlain by mixed sand and gravel.

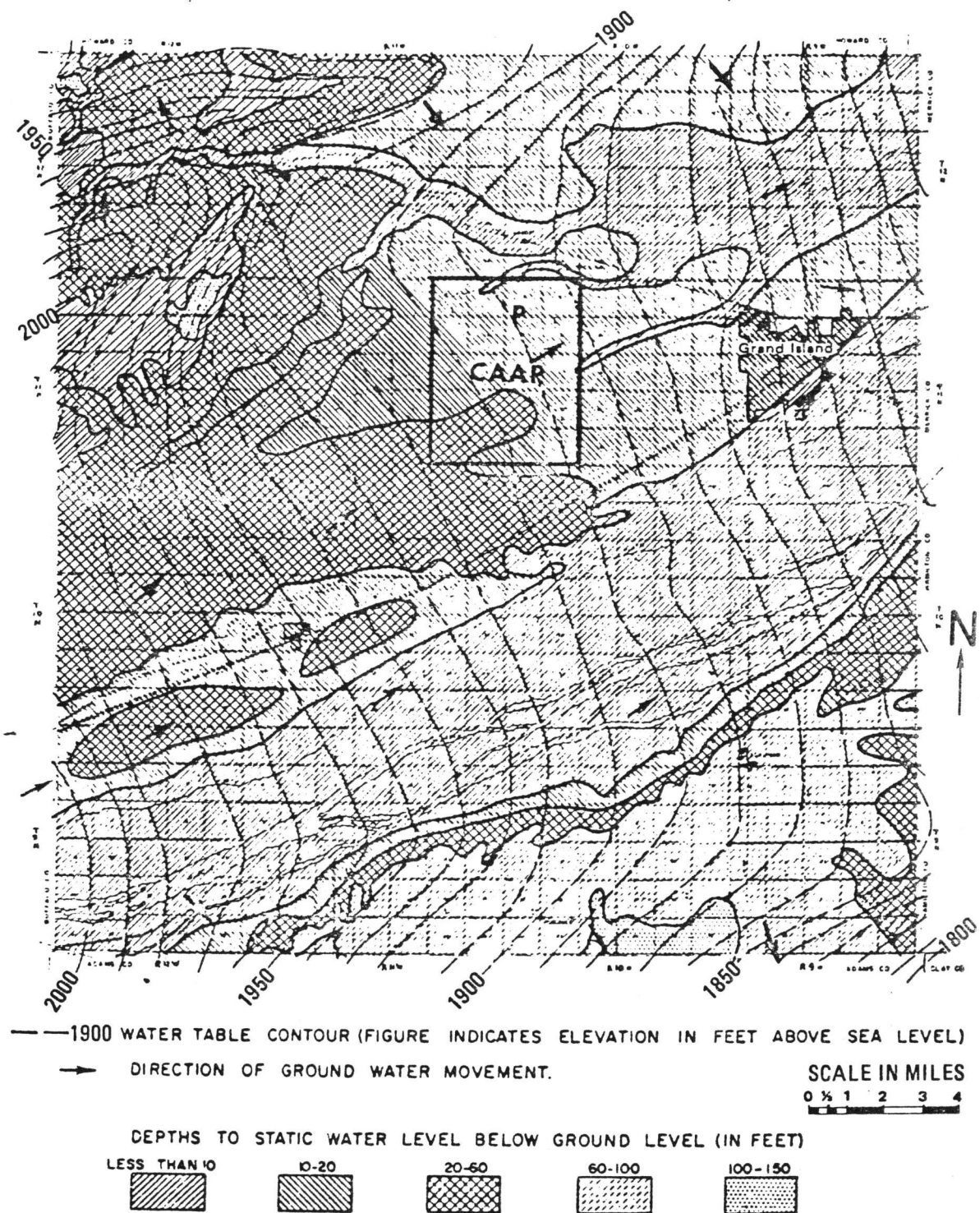


Figure 3-4. General Movement of Groundwater in Platte River Valley

Wood River soils have a friable, slightly to moderately acidic, gray to very dark grayish-brown surface horizon 25 centimeters to 51 centimeters thick. The slightly alkaline, slowly permeable subsoil is grayish-brown to dark grayish-brown silty clay. It is very firm when moist and is 38 centimeters to 61 centimeters thick. Wood River soils are imperfectly drained.

The Wood River soils are closely associated with Exline, Hall, and Hord soils. They have a thicker surface layer and subsoil than the Exline Soils, and the soluble salts, where present, are deeper in the profile. Wood River soils have a finer textured subsoil and more strongly developed blocky structure (claypan) than the Hord and Hall soils. They lack the calcareous surface layer, the high-lime subsoil, and the high groundwater level of the Silver Creek soils.

Exline Series

The Exline series consists of soils on stream terraces along the valley of the Platte River in the northeastern and north-central parts of Hall County. The soils are in nearly level positions within broad, shallow basins. They are on the higher silt-covered terraces, and on the lower terraces where the parent material is old alluvium or a mixture of alluvium and loess. On the lower terraces, where the water table fluctuates much of the year, buried soils are present in many of the soil profiles. On the higher terraces, the water table is far from the surface. Exline soils on the higher terraces probably were formed when the water level was higher.

The Exline soils are associated with the Silver Creek and Wood River soils, but have a thinner surface horizon, as well as a more strongly developed subsoil containing larger amounts of soluble salts and alkali. Soils of the Exline series lack the high lime content of Silver Creek soils. They developed in areas having a higher water table than Wood River soils. Exline soils have slow internal drainage; water stands in the buffalo wallows for weeks after rains, and surface runoff is slow.

Ortello Series

The Ortello series consists of deep soils on stream terraces and uplands that have a moderately sandy subsoil. These soils formed from sandy alluvium. In some areas, much of this material has been reworked by wind. Ortello soils occur at both low and high terrace levels in the Platte River Valley and on adjacent uplands. They are mainly nearly level, but hummocky areas with gradients up to 6 percent are included.

Ortello soils have a very dark gray to grayish-brown loam and fine sandy loam surface horizon, 20 centimeters to 51 centimeters thick. It is slightly to moderately acidic. This horizon has a weak granular or moderate crumb structure and is friable to very friable when moist.

O'Neill Series

Soils of the O'Neill series developed in loamy to sandy stream-deposited materials that are 51 centimeters to 91 centimeters deep over coarse sand or mixed sand and gravel. These soils are on nearly level stream terraces in the Platte River Valley. They occur mainly as a discontinuous band along the southern edges of the terraces. They are in an area known locally as Poverty Ridge because of the numerous crop failures before irrigation became established.

O'Neill soils are excessively drained and have a low water-holding capacity. Permeability is moderately rapid. These soils are noncalcareous throughout their profile.

Hord Series

The Hord series consists of deep soils of the stream terraces that have a thick, dark, silt loam surface horizon and a slightly lighter colored silt loam subsoil. A broad belt of these soils runs northeast to southwest across the central part of the county. The soils are mostly on nearly level to gently sloping terraces (benches), and on gently sloping fanlike terraces that are adjacent to the uplands. Small areas are on slopes alongside some of the shallow drains.

In level areas, Hord soils have a dark grayish-brown to very dark grayish-brown, friable silt loam surface horizon that is of weak, medium to coarse granular structure, and is 30 centimeters to 46 centimeters thick. This horizon grades abruptly to the subsoil, a grayish-brown heavy silt loam, to very fine sandy loam, of weak, subangular blocky structure. The underlying material at these lower levels is silty to slightly sandy alluvium, which at depths of 0.9 meters to 3.0 meters, is replaced by a deposit of coarse sand or mixed sand and gravel.

GEOLOGIC ASPECTS OF POTENTIAL MIGRATION

The subsurface at CAAP is composed of moderately to highly permeable soils. The initial 1 meter to 12 meters below the surface consists of windblown silt (Peorian loess). Beneath the loess is sand and gravel which extends down from 15 meters to 30 meters. The water table, which is in this sand and gravel material, varies from approximately 2 meters to 12 meters beneath the surface.

Data indicates that the groundwater flows toward the northeast at a rate of less than 4 meters per day. The groundwater is recharged or resupplied by stream flow of the Platte River, precipitation, and seepage of irrigation water. At CAAP, there is extensive use of irrigation wells. The water from the irrigation wells, coupled with the average rainfall (approximately 56 centimeters per year), would be expected to expedite the leaching of surface and subsurface contamination.

Based on the above geological considerations (high permeability and rapid groundwater flow), a potential exists for contaminant migration at CAAP.

CHAPTER 4

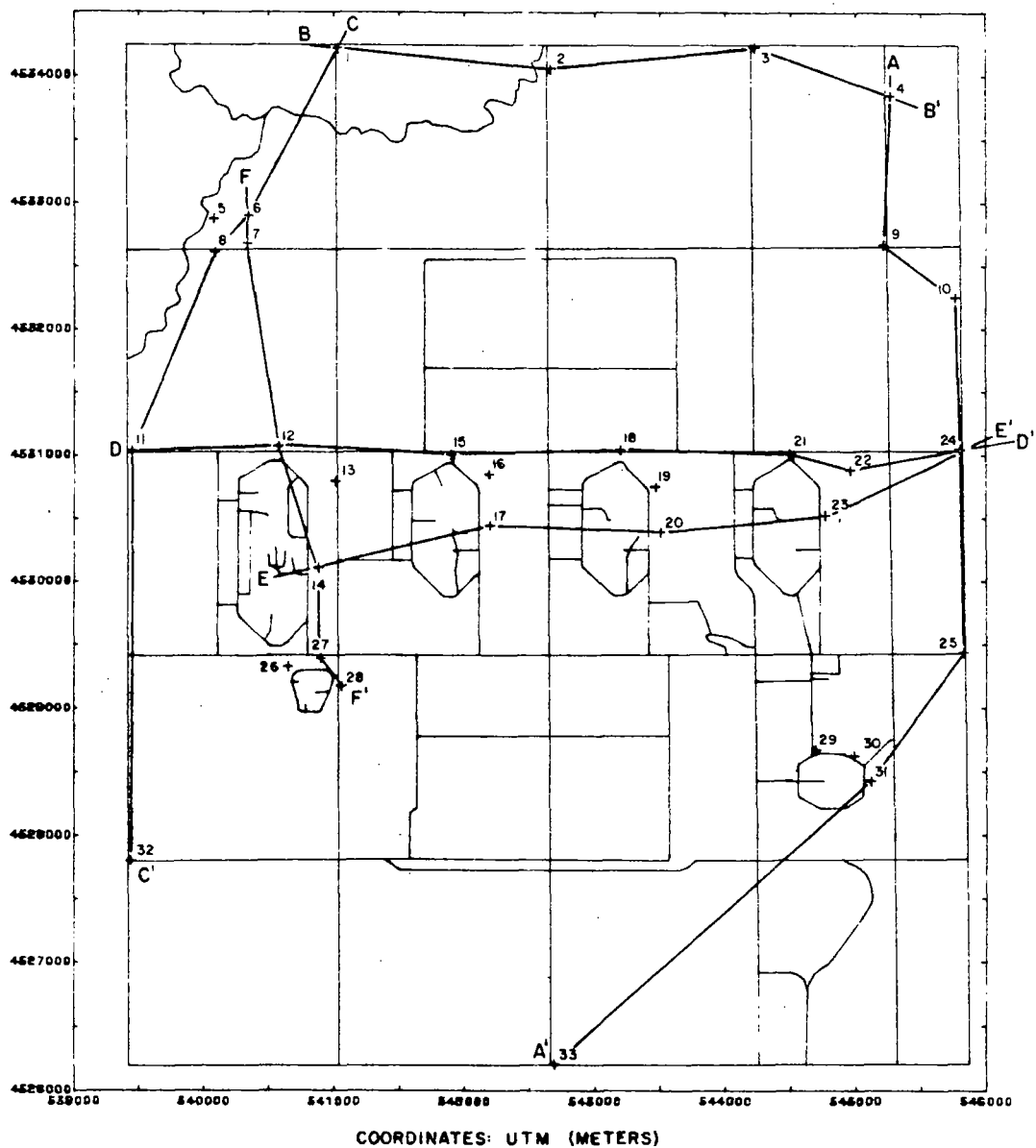
GEOLOGY AND SOILS

EEI has prepared a series of geologic cross-sections, based on the bore log information, traversing the length of the plant in several north-south, east-west lines, ranging from the boundaries to the central regions. The key to these cross-sections is given in Figure 4-1. The legend of these cross-sections is shown in Figure 4-2. In addition, four geologic fence diagrams have been prepared by EEI showing the relationship of selected adjacent wells with respect to soil type, water table, and proximity to potential contamination sources. Based upon these diagrams, a map (Figure 4-3) outlining the general soil classifications using the Unified Soil Classification System was produced.

Soils at CAAP are developed from wind blown Peorian loess material deposited over Pleistocene age sands and gravel. Top soil depths range from 12 to 24 inches, averaging 14 inches throughout most of the plant site. This top soil is very consistent in its make-up, being described as a dark brown to black, organic clayey to silty clay, with a sharp boundary at the underlying B horizon. The lower horizon varies somewhat over the plant from a dominantly light, yellowish brown, low plasticity, silty stiff clay to lenses of light yellowish brown clayey silts. Generally, the clay horizons vary in thickness from 3 to 15 feet, averaging about 10 feet. These upper clay layers tend to thin out in an easterly direction where the alluvial sands become exposed at the surface. The entire plant is underlain by alluvially deposited sands and gravels of Pleistocene era, from 50 to 100 feet thick, generally poorly graded with little or no fines and are either grey or light yellowish brown in color. This sand unit is first encountered at the surface along the eastern boundary to as deep as 18 feet below grade near the northwestern boundary. In some isolated areas, this sand layer can be described as poorly sorted (well graded) containing a homogeneous mixture of sand to pea-gravel sized particles. The soil information obtained from the boring logs corresponds well with the general geologic information described in Chapter 3, as well as the soil series descriptions of the region provided in the Request for Quotation/Scope of Work.

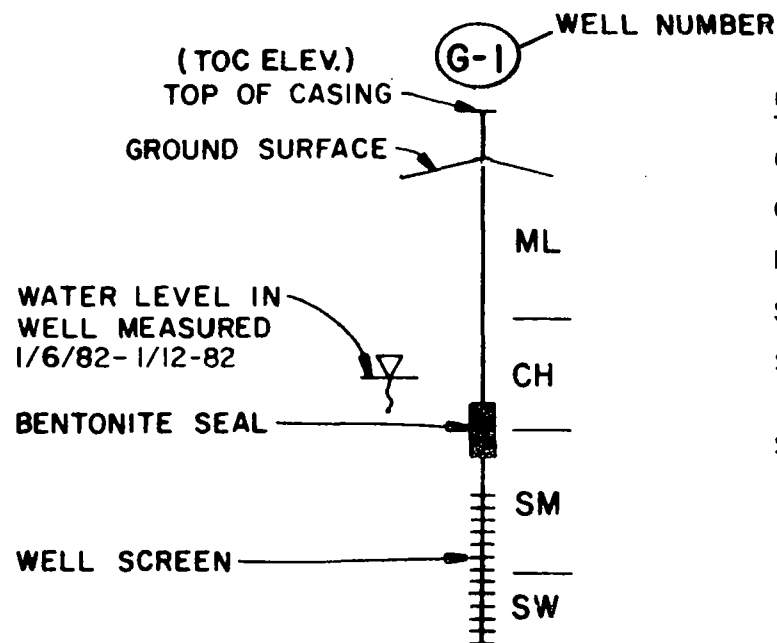
GENERAL TRENDS

Soils along the northern boundary of the plant are characterized by profile B-B' (Figure 4-4) including Wells G-1 through G-4. Well G-1 (near the northwest corner) indicates a highly plastic, stiff, olive-grey clay to 13 feet with an overlying dark brown,



LOCATION MAP FOR GEOLOGIC CROSS SECTIONS

FIGURE 4-1



GROUP CODE

CL - LOW PLASTICITY SILTY CLAY
 CH - HIGH PLASTICITY SILTY CLAY
 ML - SILTS / VERY FINE SANDS
 SM - SILTY SANDS
 SW - WELL GRADED SANDS /
 ALLUVIUM
 SP - POORLY GRADED SANDS /
 ALLUVIUM

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FIGURE 4-2
 GEOLOGIC CROSS SECTION
 LEGEND

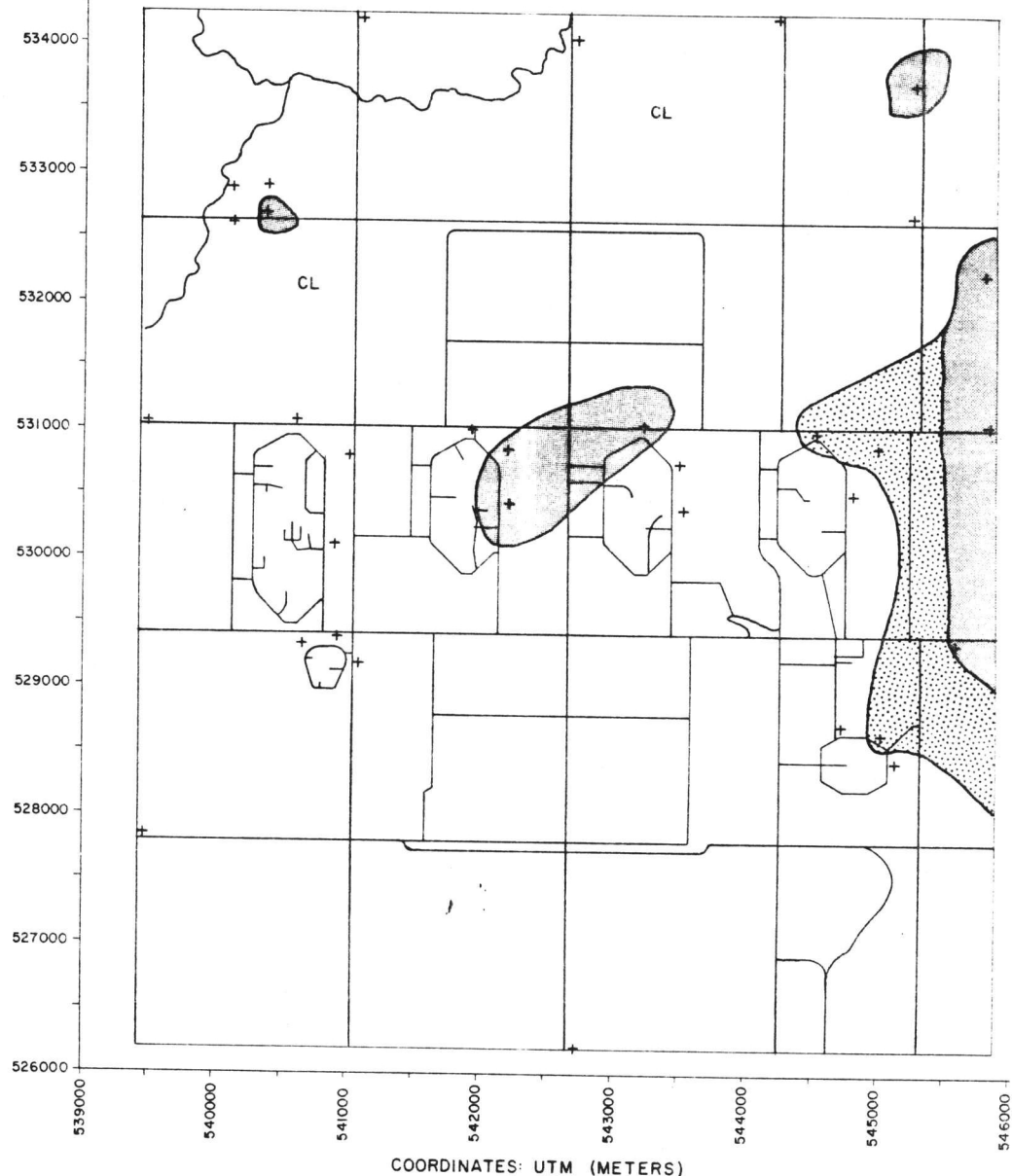
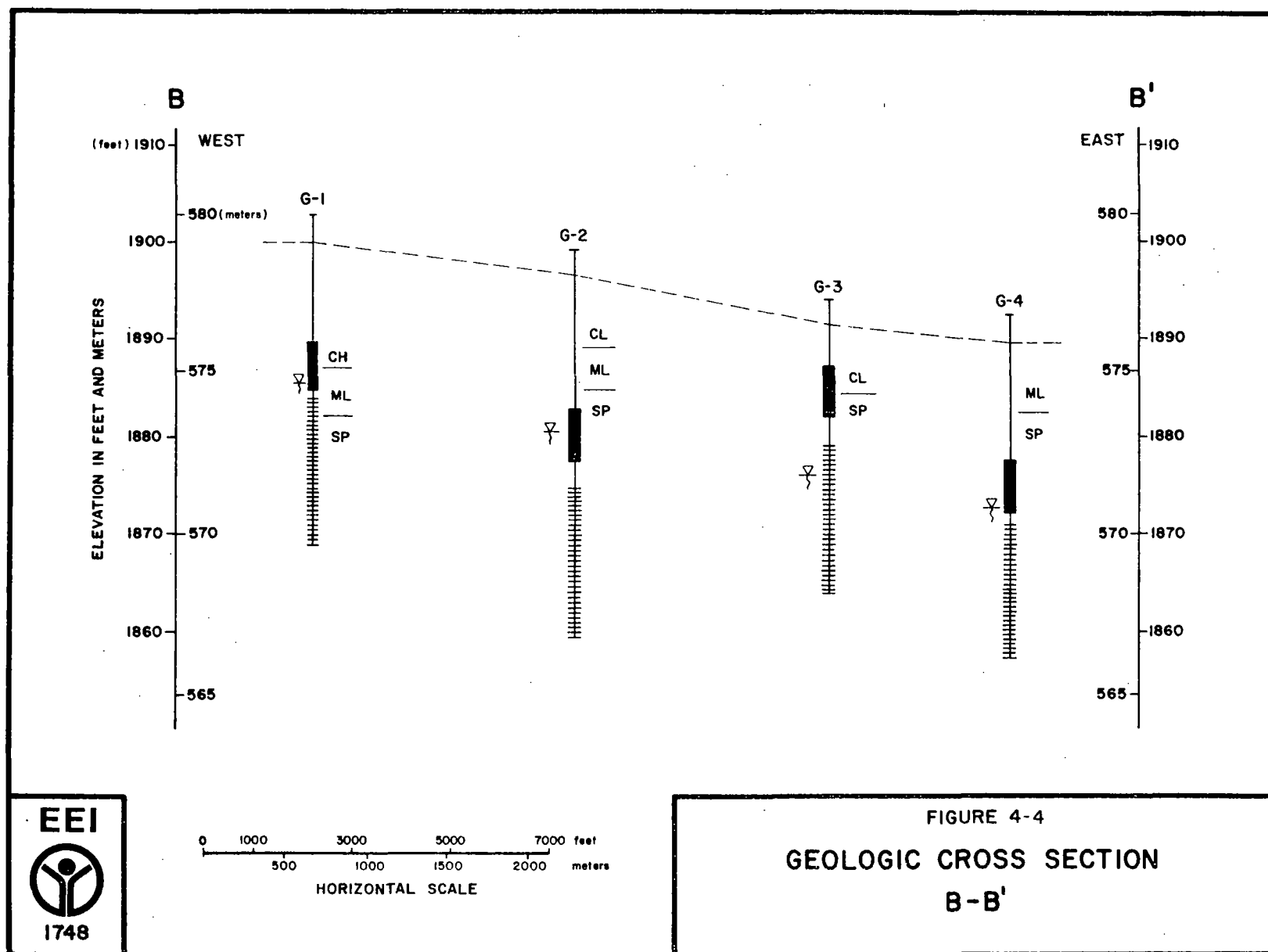


FIGURE 4-3

SOILS MAP

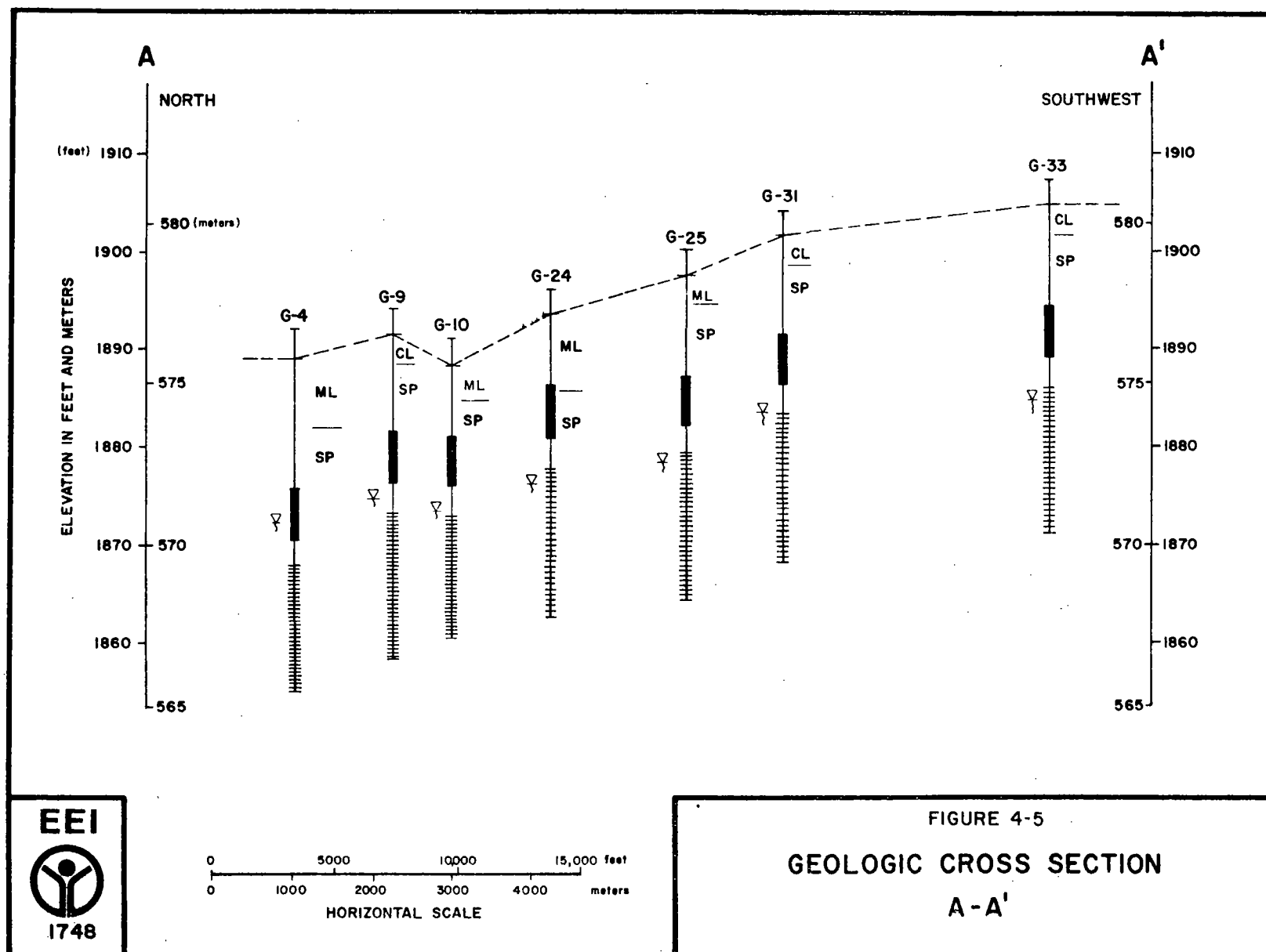
UNIFIED SYSTEM

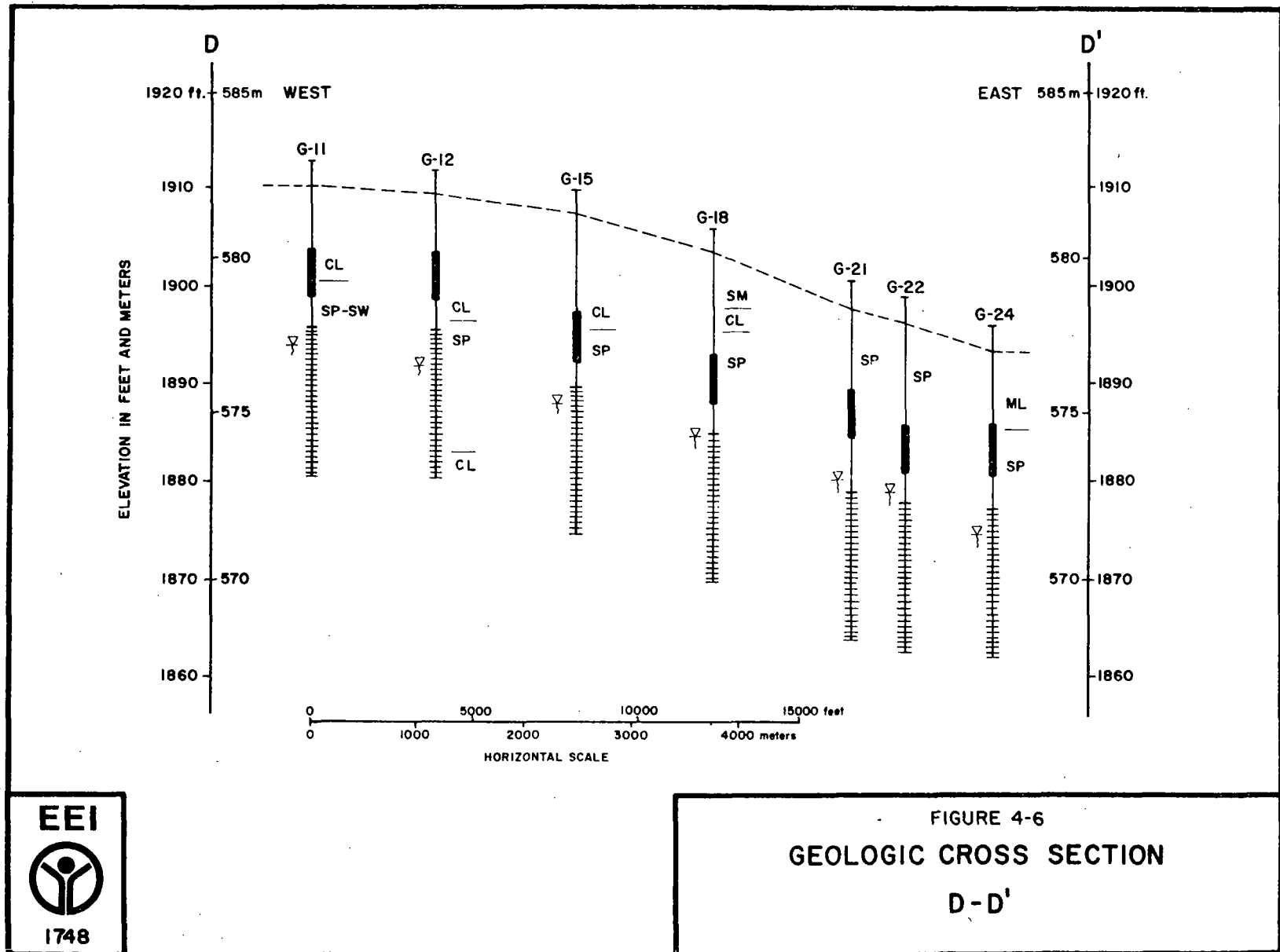


organic clayey top soil to one foot. At 13 feet, a dark olive grey, loose clayey silt is found and continues to a depth of 18 feet where the underlying poorly graded sands are encountered. The alluvial nature of this layer is evidenced by the steadily increasing coarseness of the particles to a bore depth of 35 feet. Continuing eastward along the northern boundary, the logs of Wells G-2 through G-4 show a steady transition from the highly plastic, stiff clay to a loose clayey silt on the eastern edge at G-4. The top soil remains consistent in its make-up along this entire length. The clay horizon becomes less plastic and shallower, and grades laterally to a silty clay between G-2 and G-3. The poorly graded sands continue to be found at increasingly shallower depths in an easterly direction, but retain their increasing coarseness with depth.

The eastern boundary reveals a more significant change in soil character and is depicted in Figure 4-5, cross-section A-A'. Upper horization along the east boundary is notably shallow and variable, with the exception of the loess top soil. The top soil remains consistent throughout the cross-section, described as a one foot thick dark grey to black, organic clay. The upper horizon is deepest at G-4 with a 7-foot layer of clayey silt. Toward the south, a transition to a very thin silty clay solum is shown at G-9, to a depth of only 3 feet, with poorly graded sands below. Another transition to a loose clayey silt takes place towards G-10, with a thin layer to 3.5 feet overlying the sands. Traveling south towards G-24 and G-25, a long band of transitional, very fine sands and clayey silts are revealed to a depth of 8 feet at G-24. This horizon becomes shallower again at G-25 with a depth of only 3 feet. Well G-31 has a thin, 2-foot horizon of silty clay, which possibly extends to G-33 at the southern most, central point. Underlying this entire profile is the poorly graded alluvial sands sorting vertically to medium and coarse sands and finally pea-gravel sized particles of the deepest bore depth encountered at G-33 and G-4 of 40.5 feet.

Cross-section D-D' (Figure 4-6) provides a view across the mid-section of the plant from the western boundary to the eastern boundary. The horization found along this line is similar to that encountered along the northern boundary, revealing relatively deep layers of stiff, low plasticity silty clay, from very dark greyish brown to olive in color. The clay layer reaches to 10 feet at G-11 and 12 feet at G-15. A second clay horizon appears at 28 feet in G-12, and extends at least to the bottom of the boring at 30.5 feet. The material is a dark grey, stiff, low plasticity, silty clay; similar to that encountered above from 1 to 13 feet. This is the only encounter of a second clay deposit along this particular profile. At G-18 the light yellowish brown silty clay horizon thins to a 2-foot layer, overlain by a



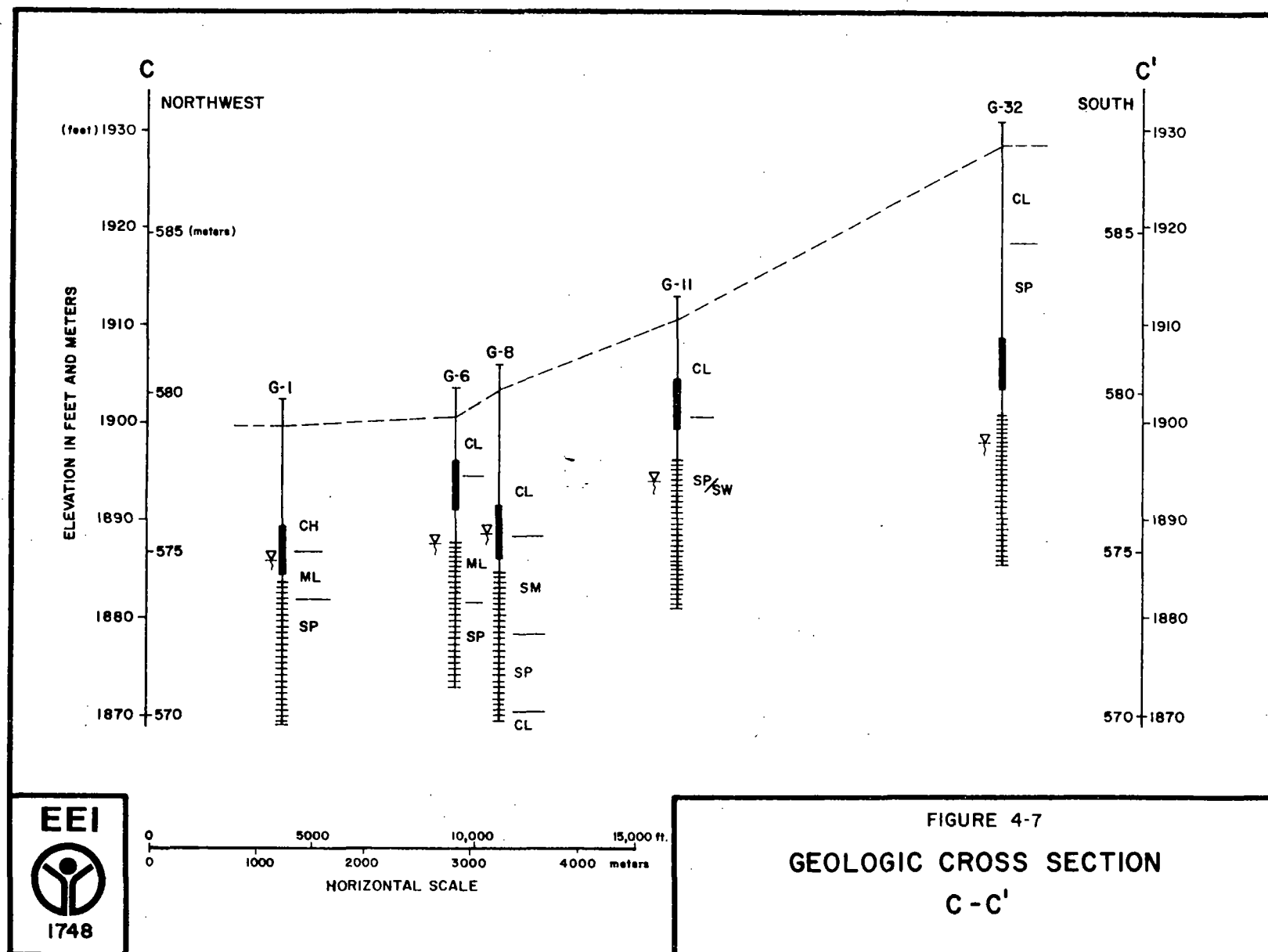


yellowish brown silty sand to a 6-foot depth. The alluvial, light yellowish brown sand layer is encountered beneath the clay layer at 8 feet to a depth of at least 30.5 feet. It crops out at the surface as noted at G-21 and G-22. This sand outcrop extends at least to G-30, several thousand feet south as shown on Figure 4-3. The sands are well sorted from fine sands to pea-gravel to a bore depth of 40.5 feet at G-21 and G-22. Moving east to the boundary at G-24, a light yellowish brown fine sand is encountered to 8 feet, where the alluvial medium and coarse sand is found to a bore depth of 40.5 feet. The topsoil along this profile, including the outcrop band of sandy alluvium is consistent, with a depth of one foot of black to dark brown organic clays.

The cross-sectional profile depicted in Figure 4-7 runs along the west boundary from the northwest corner of the CAAP installation (G-1) south to G-32 in the southwestern corner. This profile shows a consistent, fairly uniform horization running the entire length of the boundary. G-1 has a highly plastic, stiff, olive grey clay to a depth of 13 feet. This grades to a dark olive grey loose clayey silt to 18 feet. Below lies the alluvial medium to coarse sands with some pea-gravel to at least a 40.5-foot bore depth. The upper clay horizon continues on southward, varying in depth from 6 feet at G-6 to 15 feet at G-8. This clay layer also tends to become less plastic, light yellowish brown in color and more silty in texture. The clayey silt layer described in G-1 continues on through G-6 to a depth of 13 feet. This layer appears to thin out considerably to G-8, where it becomes a fine sand/clayey silt transitional zone to 25 feet. South of G-8, this middle layer thins out completely, creating a sharp boundary between the upper silty clay horizon and the underlying alluvium south to G-32. The surface one-foot organic topsoil horizon remains consistent throughout the profile as a dark brown to black clay.

Profile E'E' (Figure 4-8) runs from Line 4 at G-14 to the east gate at G-24. This cross-section reveals a continuous fine grained material in the upper horizon to a depth of 7 to 13 feet. The texture of this material varies laterally from a loose clayey silt at G-17 to a deep silty clay at G-20. As shown on Figure 4-2, the poorly graded sands probably crop out between G-23 and G-24. These sands underlie the profile to at least the bore depth of 35.5 feet.

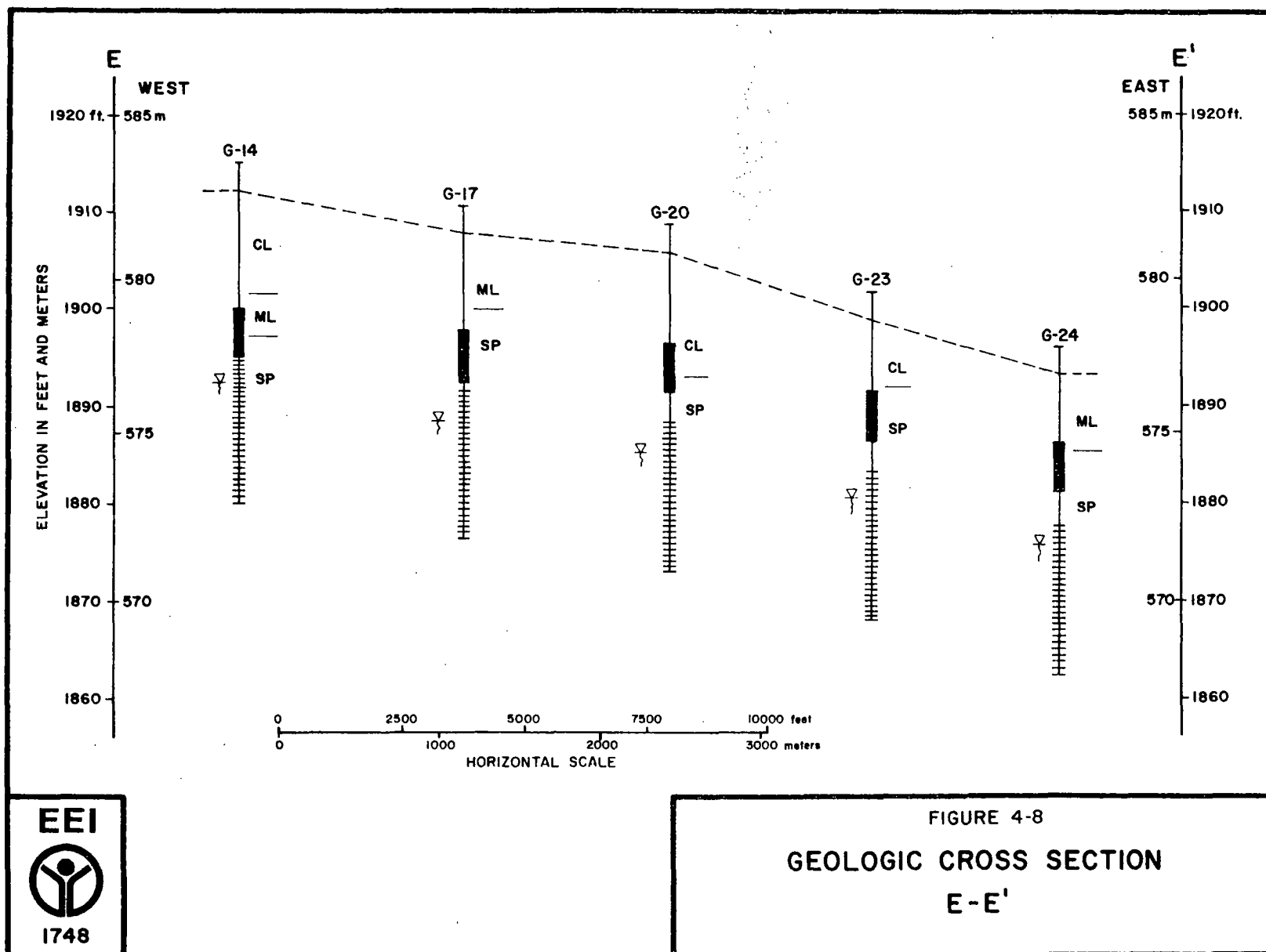
Figure 4-9 shows a short cross-section running between G-6 (F) near the northwest corner of the burning grounds to G-28 (F') just east of Load Line 5. This profile generally correlates well with the three intersecting profiles (C-C', D-D' and E-E') and shows the silty clay upper horizon varying in depth from

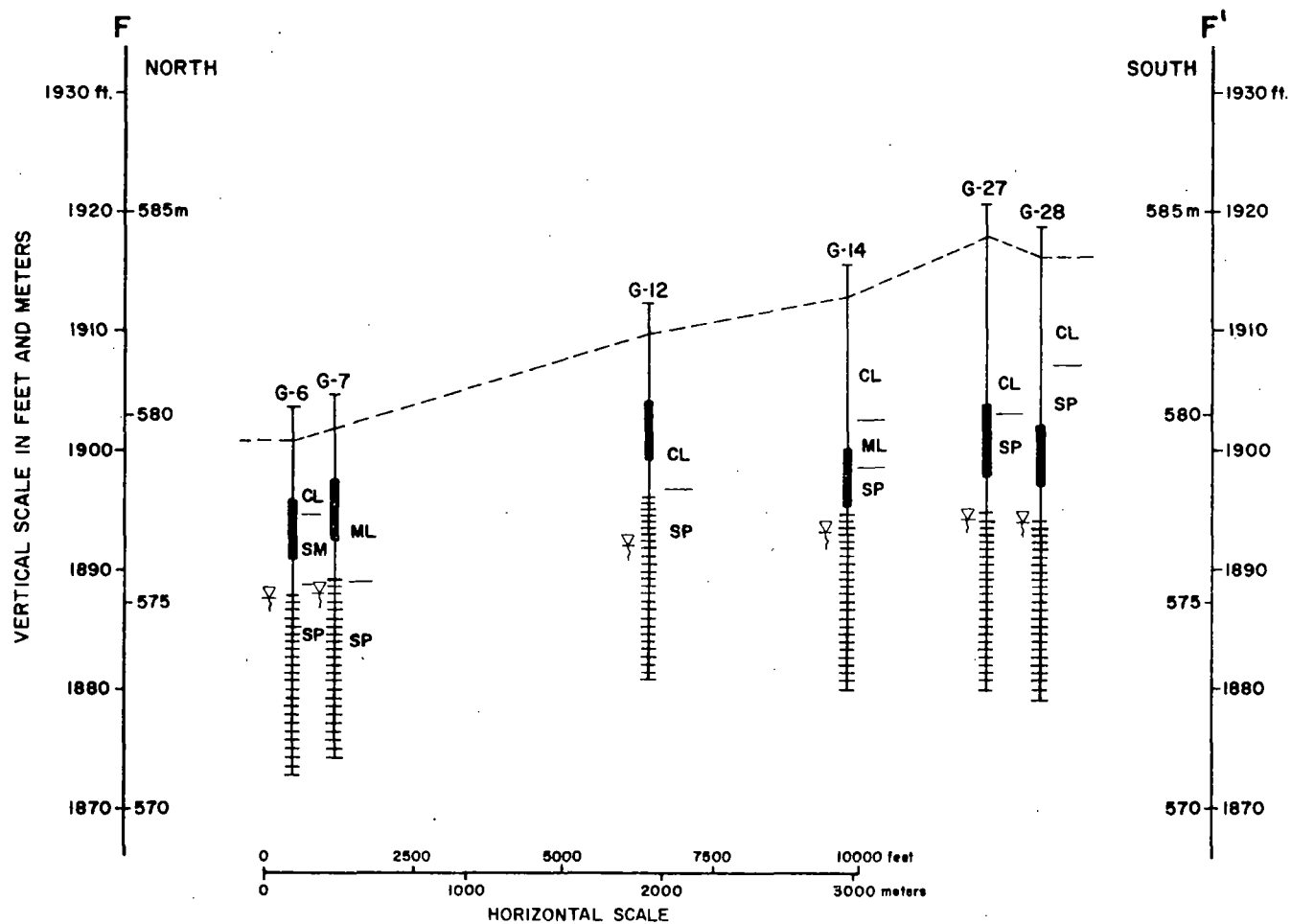


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FIGURE 4-9
GEOLOGIC CROSS SECTION
F - F'

6 feet at G-6 to 15 feet at G-27. A break from this pattern occurs around G-7, where the surface layer changes to a clayey silt to 13 feet. The entire profile is underlain by loose sand alluvium to at least 40.5 feet. Surface horization along the cross-section remains consistent with 12 to 18 inches of dark brown to black organic clayey topsoil.

AREAS OF CONCERN

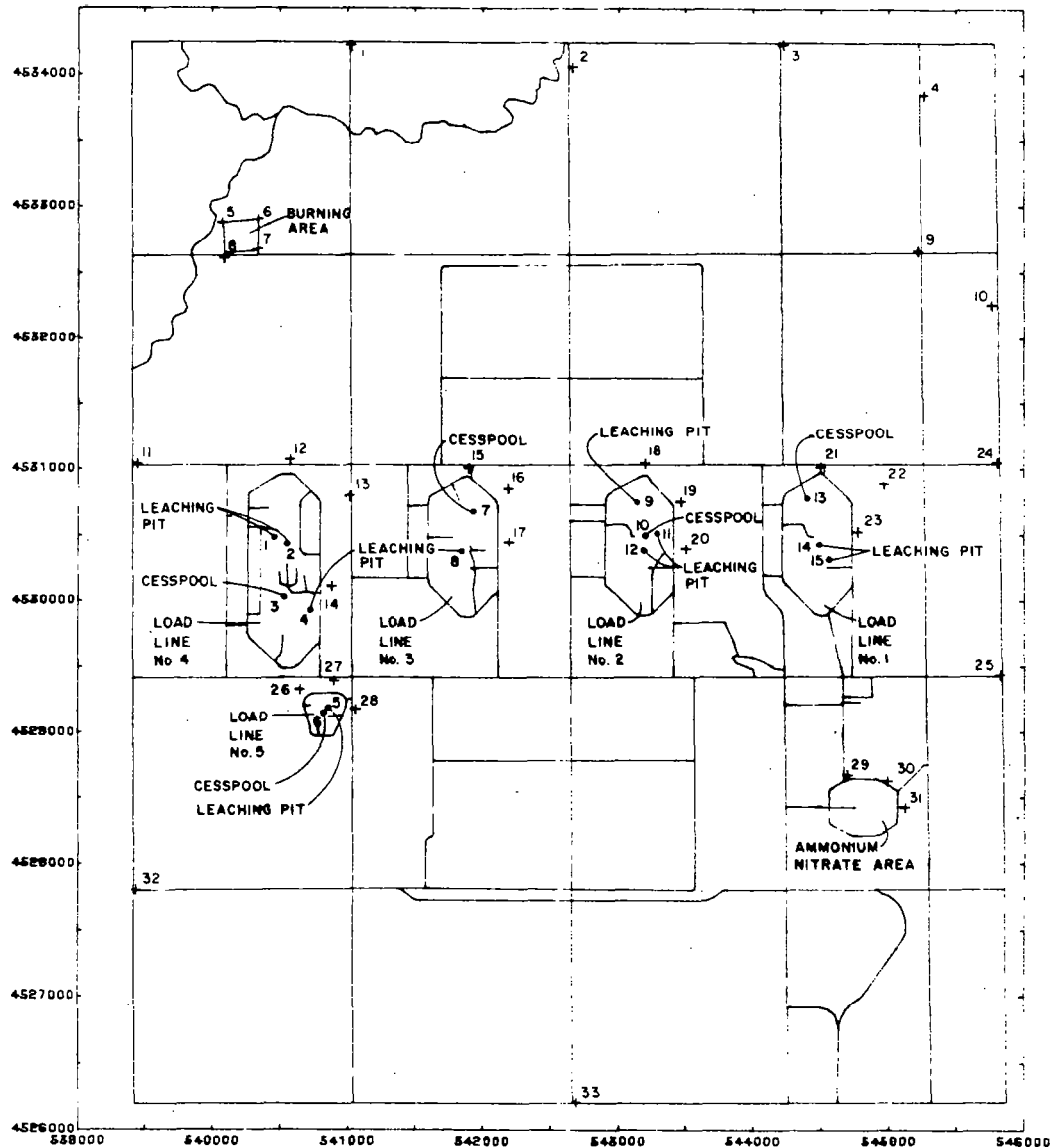
The particular areas of concern consist of the five load lines, the ammonium nitrate area, and the currently abandoned burning ground (Figure 4-10). The soils of these areas are depicted in a series of schematic load line cross-sections (Figure 4-11), showing their associated leaching pits and cesspools. Soils information for these cross-sections is based on projections from the logs of the nearest wells. The geologic fence diagrams mentioned earlier aid in delineating the relative positions of the pits and cesspools with respect to the wells, as well as the relationships of the wells with respect to the burning ground and ammonium nitrate areas.

Load Line 1

Figures 4-12 and 4-13 show the soils here as consisting of a silty clay layer to 7 feet at the southern end of the line, thinning to zero thickness at the northeast. The leaching pits (S14 and S15) are well within this clay layer, but the bottom of each approaches the boundary to the sandy sub-layer. The deep cesspool (S13) lies only partially into the clay, with the floor wholly exposed in the sandy sub-layer. This sand layer is a poorly graded alluvium with particle sizes ranging from fine sands to pea-gravel to the bore depth of 35.5 feet.

Load Line 2

Leaching Pits S9, S11 and S12 range from 10 to 12 feet with the bottom of each still within the silty clay layer (Figure 4-14). The silty clay layer in this area is approximately 13.5 feet deep, resulting in a buffer horizon for the leaching pits of only 1.5 to 3 feet. Below this silty clay is alluvial sand, as described earlier. The cesspool S10 is excavated into the boundary between the silty clay and fine sands, as evidenced by the textures recorded at the time of sampling (Table 4-1).

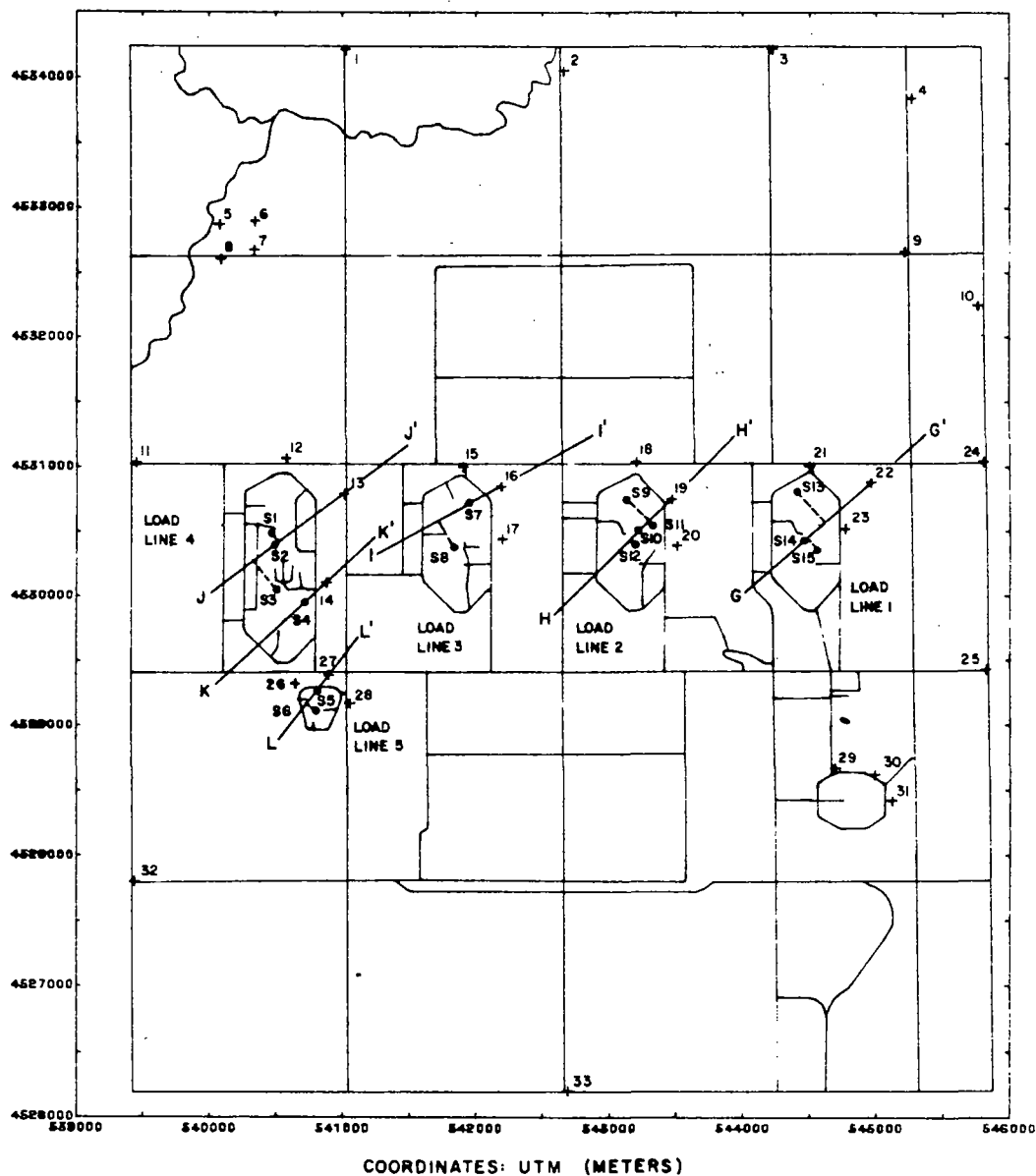


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MANUFACTURING AND WASTE DISPOSAL AREAS

FIGURE 4-10



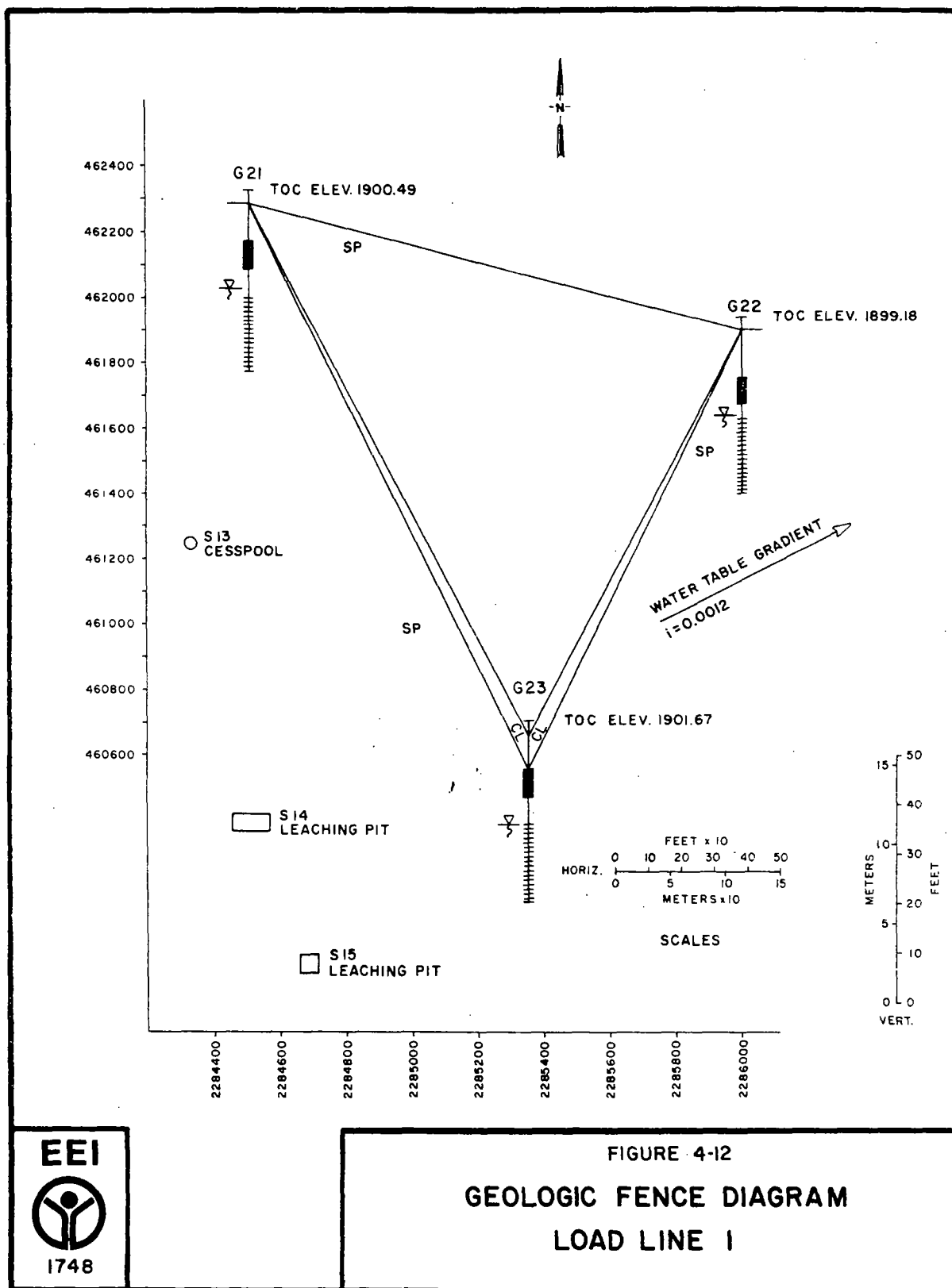
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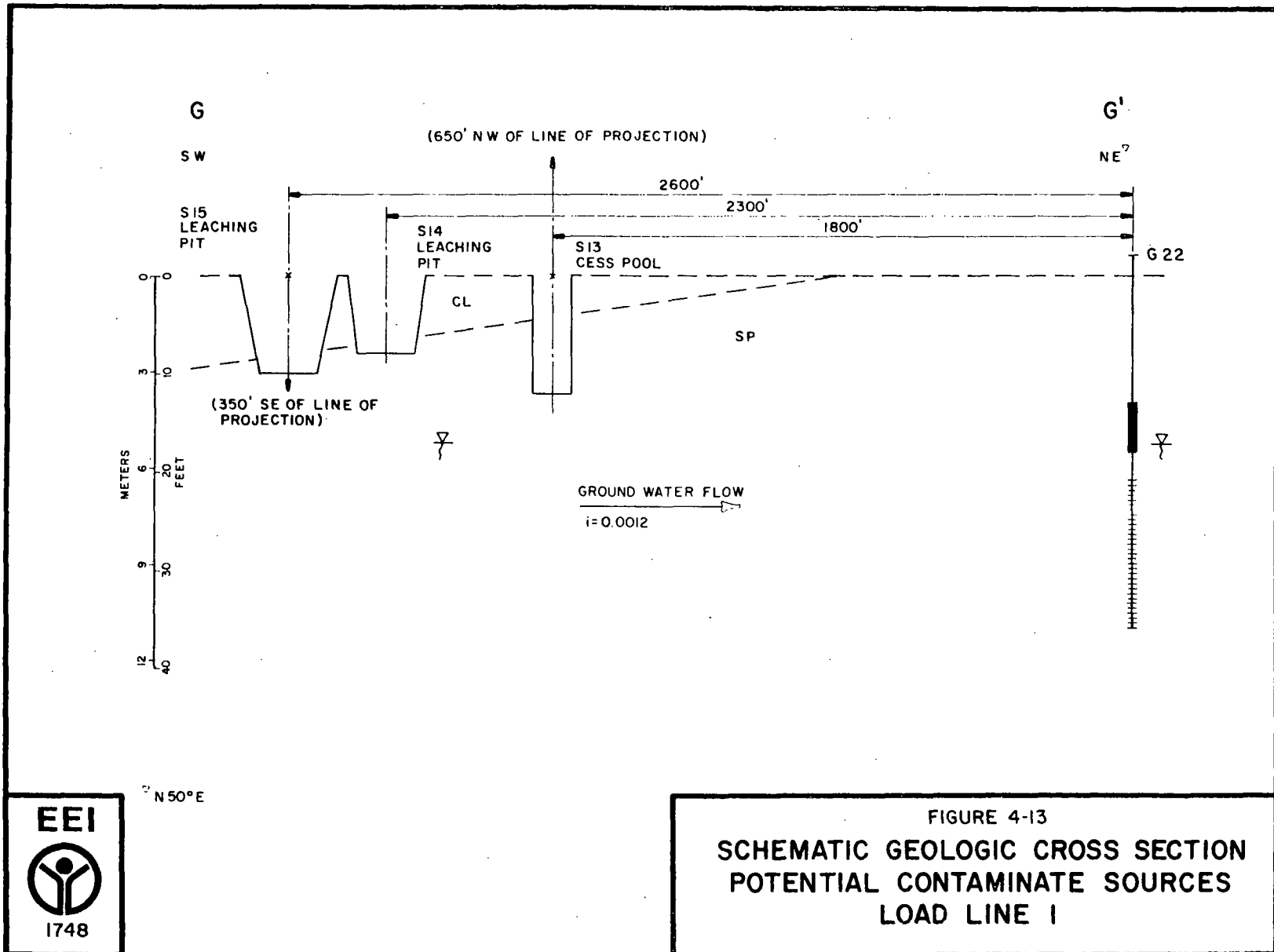


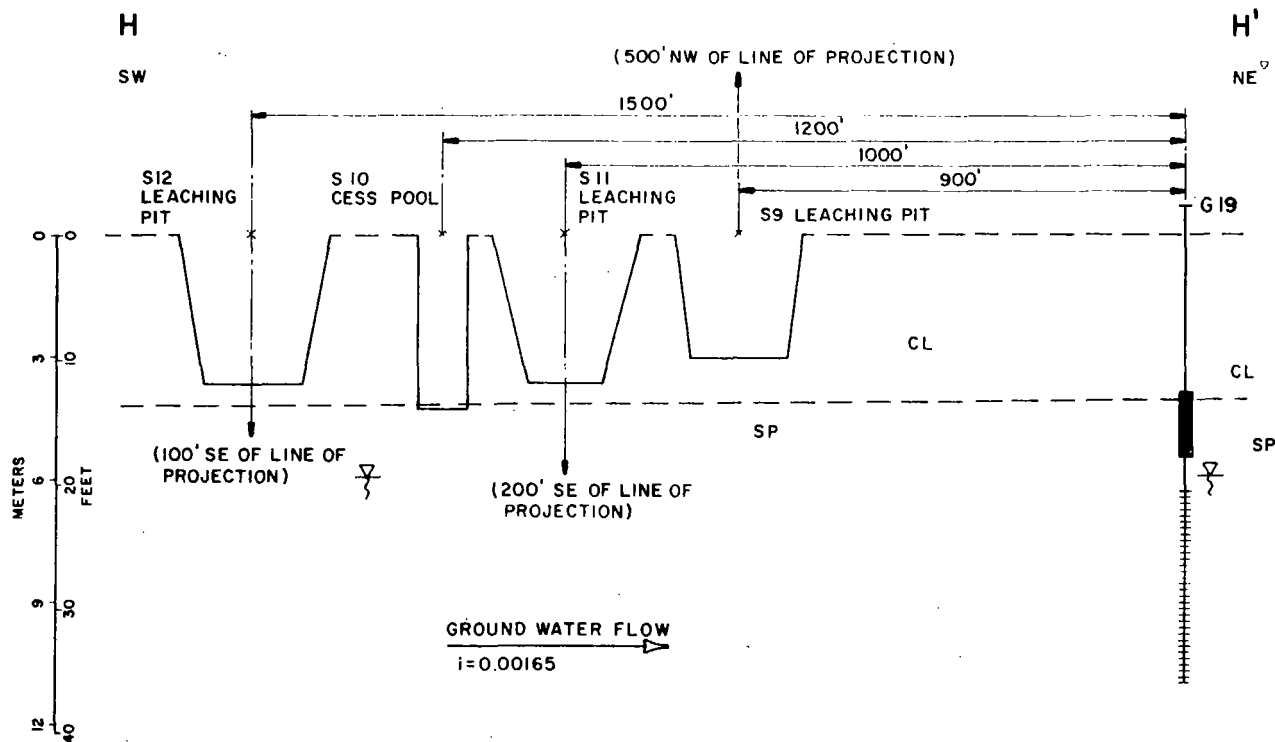
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FIGURE 4-II

KEY TO
SCHEMATIC GEOLOGIC CROSS SECTION
POTENTIAL CONTAMINATE SOURCES







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N56°E

FIGURE 4-14

SCHEMATIC GEOLOGIC CROSS SECTION
POTENTIAL CONTAMINATE SOURCES
LOAD LINE 2

TABLE 4-1
CORNHUSKER ARMY AMMUNITION PLANT SOIL SAMPLING

Soil Sample Site	Description	Dimensions (feet)	Sample Depth (inches)	Texture (inches)	Date Sampled	Comments
S1	Leaching Pit (Line 4)	60 x 50 ≈10 deep	A 0-18 B 18-36	0-18 silty clay loam 18-36 clay loam	1/11/82	Composite of three samples Ground frozen from 0- 4 inches
S2	Leaching Pit (Line 4)	125 x 50 ≈10 deep	A 0-18 B 18-36	0-36 silty clay loam	1/11/82	Composite of three samples
S3	Cesspool (Line 4)	12 dia. ≈15 deep	A 0-18 B 18-36	0-24 fine-medium sand 24-36 sandy loam	1/11/82	Composite of three samples
S4	Leaching Pit (Line 4)	50 x 40 ≈10 deep	A 0-18 B 18-36	0-36 sandy loam	1/11/82	Composite of three samples Ground frozen from 0-8 inches
S5	Leaching Pit (Line 5)	80 x 55 ≈10 deep	A 0-18 B 18-36	0-32 silty clay loam 32-36 sand	1/11/82	Composite of three samples Soil saturated at 12 inches
S6	Cesspool (Line 5)	6 dia. ≈14 deep	A 0-18 B 18-36	0-1 compacted sandy loam 1-36 sandy loam	1/11/82	Composite of three samples Soil saturated
S7	Cesspool (Line 3)	8 dia. ≈18 deep	A 0-18 B 18-36	0-18 sandy loam 18-36 fine-medium sand	1/11/82	Composite of three samples
S8	Leaching Pit (Line 3)	110 x 50 ≈10 deep	A 0-18 B 18-36	0-36 silt loam	1/9/82	Composite of three samples Ground frozen from 0-2 inches
S9	Leaching Pit (Line 2)	65 x 45 ≈10 deep	A 0-18 B 18-36	0-34 silty clay loam 34-36 fine-medium sand	1/9/82 1/9/82	Composite of three samples Ground frozen from 2-4 inches
S10	Cesspool (Line 2)	8 dia. ≈14 deep	A 0-18 B 18-23	0-18 silty clay loam 18-23 compacted sandy gravel	1/9/82	0-18 inches composite of three samples 18-23 inches composite of one sample 2-5 second flame noticed
S11	Leaching Pit (Line 2)	110 x 75 ≈12 deep	A 0-18 B 18-36	0-36 silty clay loam	1/9/82	Composite of three samples Ground frozen from 1-3 inches
S12	Leaching Pit (Line 2)	50 x 40 ≈12 deep	A 0-18 B 18-36	0-36 silty clay loam	1/9/82	Composite of three samples Ground frozen from 1-3 inches
S13	Cesspool (Line 1)	10 dia. ≈12 deep	A 0-18 B 18-36	0-36 medium sand	1/9/82	Composite of three samples
S14	Leaching Pit (Line 1)	70 x 20 ≈8 deep	A 0-18 B 18-36	0-30 silty clay loam 30-36 medium-coarse sand	1/9/82	composite of three samples Ground frozen from 0-4 inches
S15	Leaching Pit (Line 1)	40 x 30 10 deep	A 0-18 B 18-36	0-36 Silty clay loam	1/9/82	Composite of three samples Ground fromzen from 0-2 inches

Load Line 3

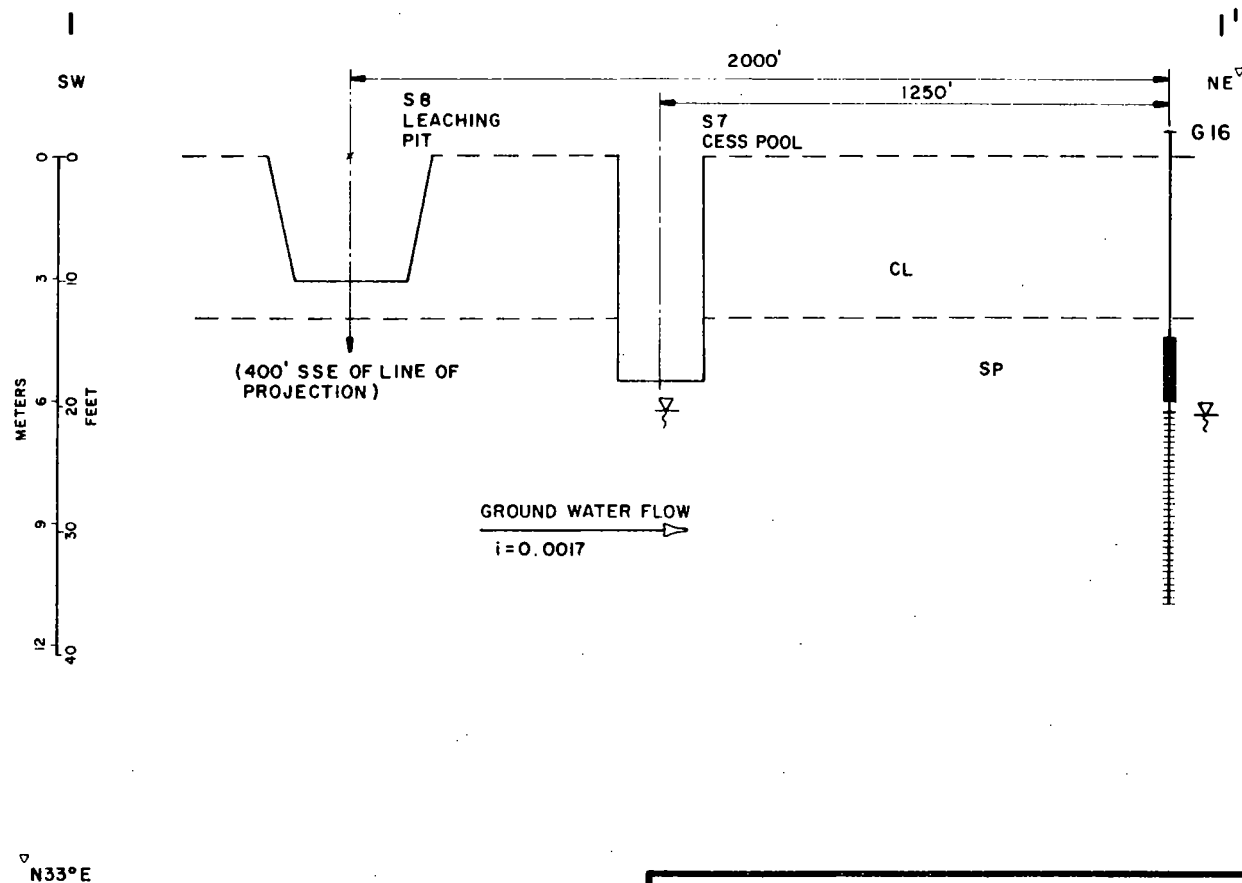
Only two pits were sampled in Load Line 3 including S8, leaching pit and S7, cesspool. The soil make-up (Figure 4-15) is a continuation of the pattern found in Load Line 2, with a fairly deep layer of silty clay to 13 feet, underlain by the alluvial sands. The leaching pit (S8) extends into the clay horizon to a depth of 10 feet, with an estimated 3 feet of clay between the bottom of the pit and the underlying sand layer. The cesspool (S7) extends 5 feet into the sand layer to a total depth of 18 feet. The soil texture in the bottom of the cesspool at 0 to 18 inches is a sandy loam, and at 18 to 36 inches, a fine to medium sand.

Load Line 4

Figure 4-16 depicts the cross-section of S1, S2 and S3 in relation to the surface geology and the position of Well G-13, while Figure 4-17 shows the same relationship of S4 to Well G-14. The cesspool S3 extends down through the silty clay and into the middle horizon of yellowish brown, loose, silty sand to a depth of approximately 15 feet. The bottom of the 16-foot deep cesspool intersects the contact of the silty sand with the underlying alluvial sand. The leaching pits (S1 and S2) are excavated into the silty clay layer, with about 2.5 feet between the pit bottoms and the sandy alluvium. Leaching Pit S4 is about 10 feet deep and, based on Table 4-1, extends into the silty sand horizon mentioned at S3. The alluvial sand is encountered at a depth of 14.5 feet.

Load Line 5

The soil stratigraphy for Load Line 5 is relatively uncomplicated as depicted in the load line cross-section, Figure 4-18, and in the geologic fence diagram, Figure 4-19. The S6 cesspool extends to a depth of 14 feet, which is about one-foot into the alluvial sand horizon. The soil texture within the cesspool at 14 feet is a compact sandy loam to 12 inches, with a sandy loam to 36 inches. The leaching pit (S5) is 10 feet deep, making the vertical distance from the pit bottom through the silty clay to the alluvial sand horizon about 3 feet. Texture determination of the soil collected during sampling of S5 denotes a silty clay loam texture to a depth of 32 inches below the bottom. Sand was encountered below 32 inches.



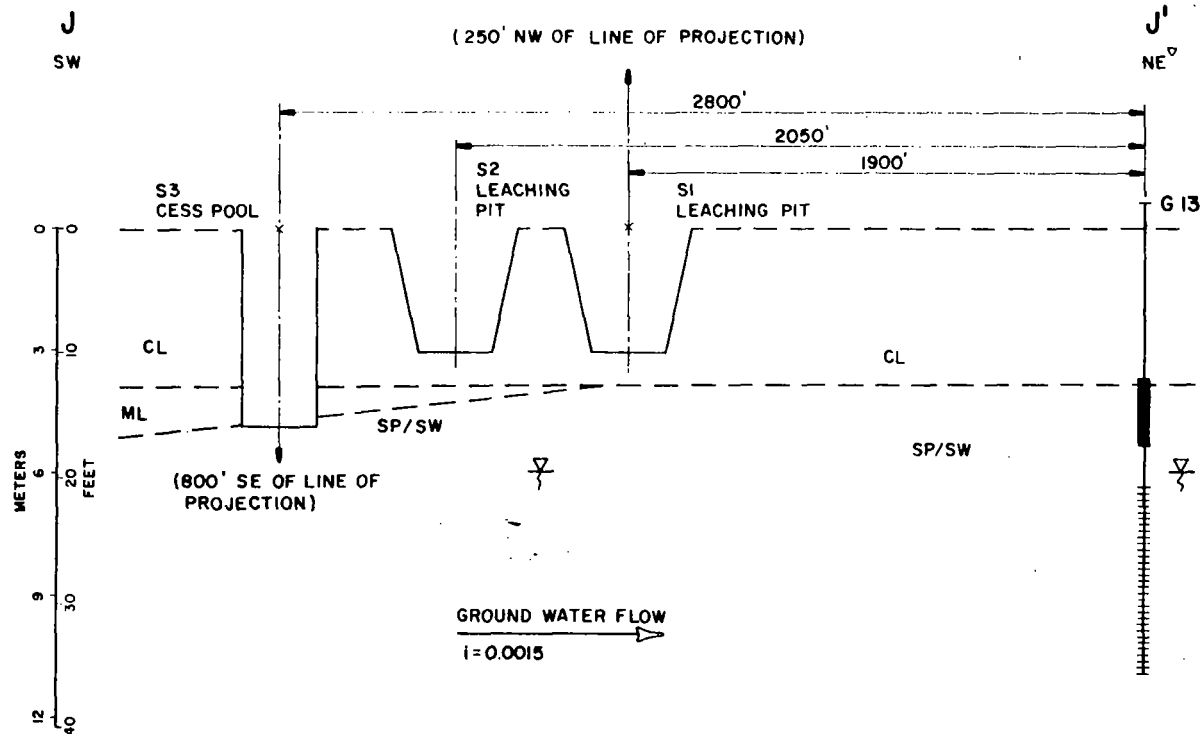
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FIGURE 4-15

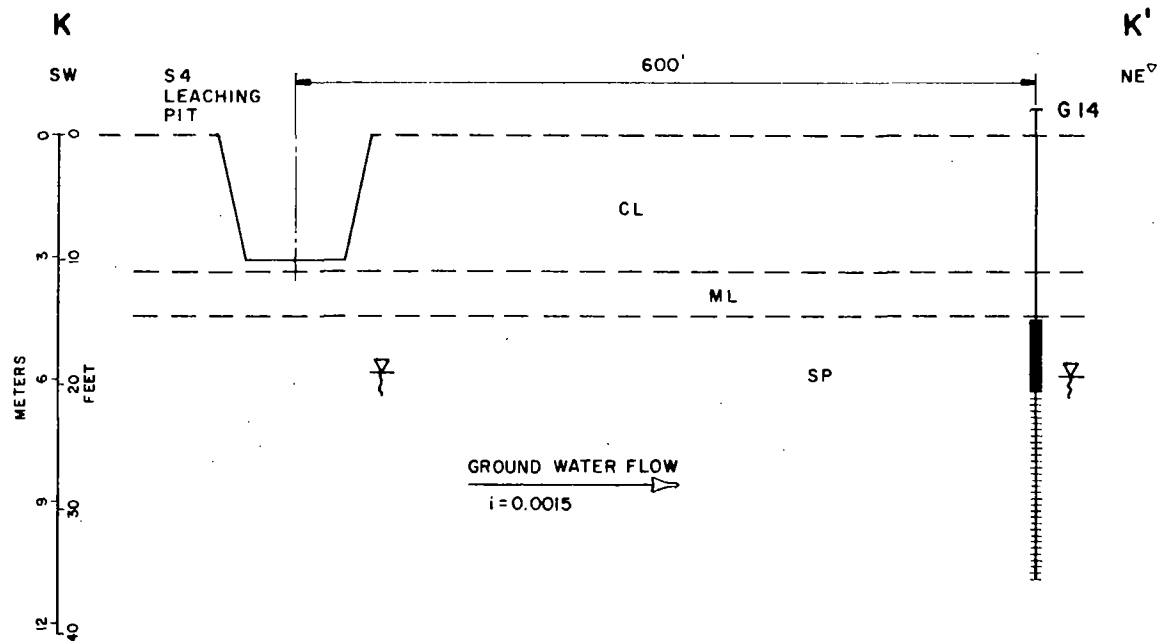
**SCHEMATIC GEOLOGIC CROSS SECTION
POTENTIAL CONTAMINATE SOURCES
LOAD LINE 3**



N 40° E

FIGURE 4-16
SCHEMATIC GEOLOGIC CROSS SECTION
POTENTIAL CONTAMINATE SOURCES
LOAD LINE 4

(1 OF 2)



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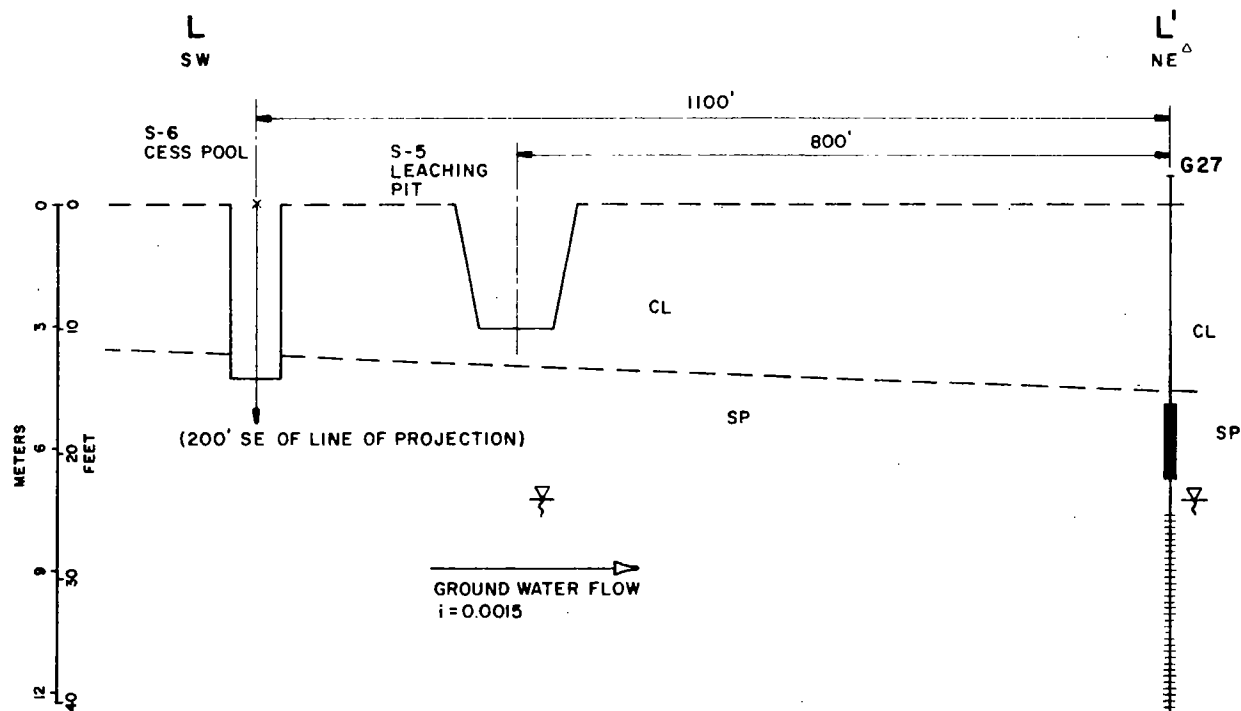


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N42°E

FIGURE 4-17
SCHEMATIC GEOLOGIC CROSS SECTION
POTENTIAL CONTAMINATE SOURCES
LOAD LINE 4

(2 OF 2)



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$\Delta N66^\circ E$

FIGURE 4-18

SCHEMATIC GEOLOGIC CROSS SECTION
POTENTIAL CONTAMINATE SOURCES
LOAD LINE 5

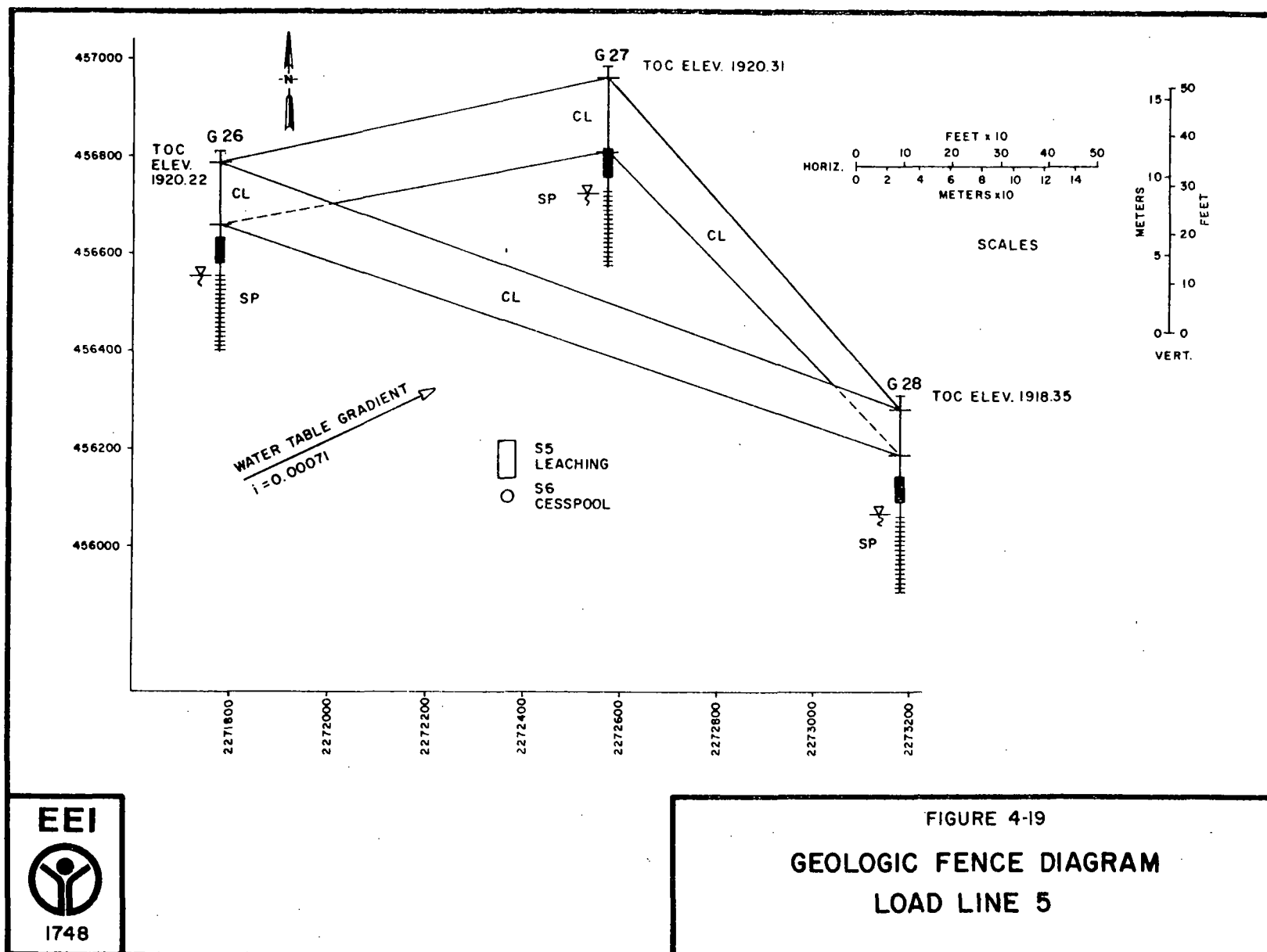


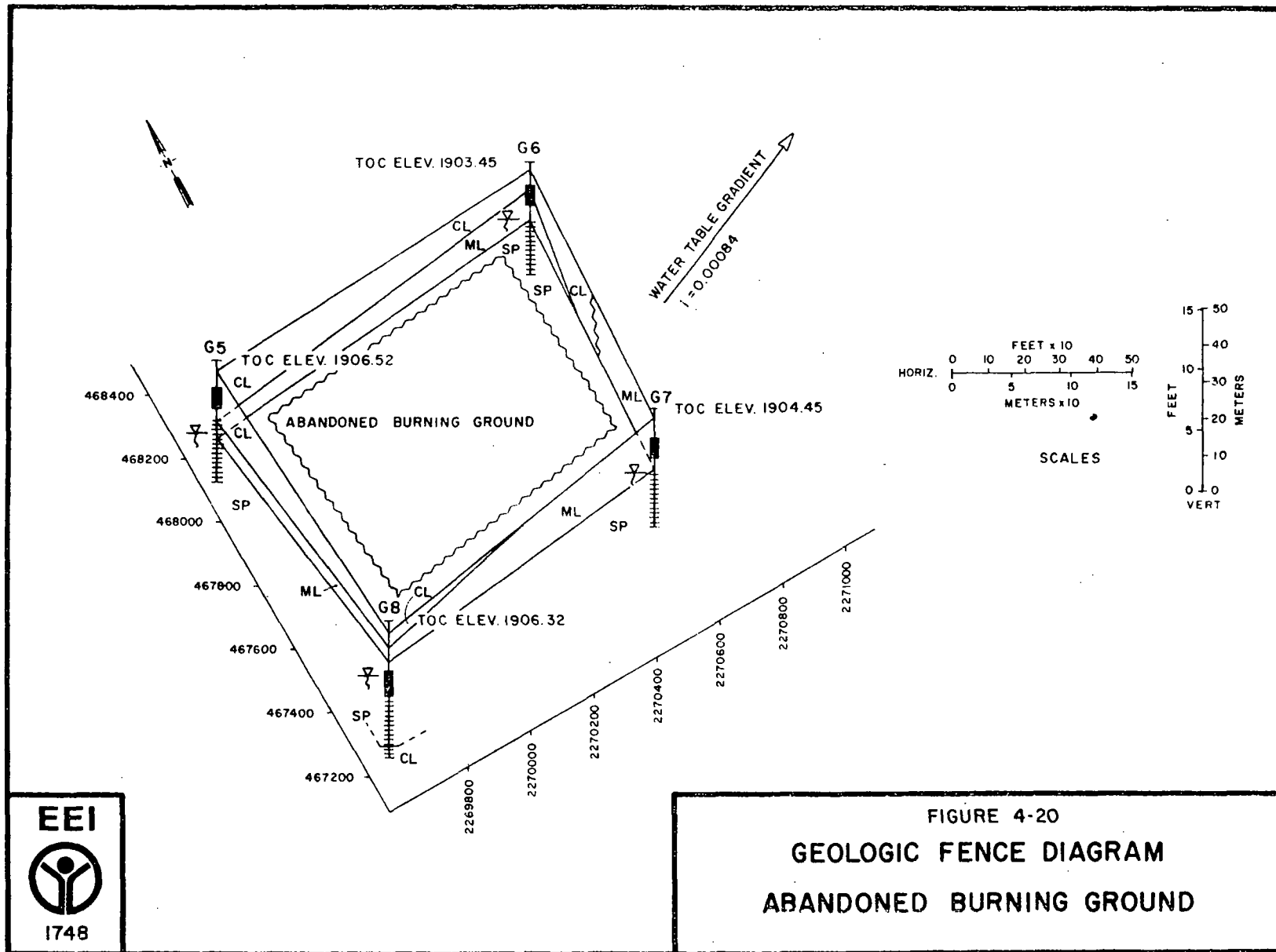
FIGURE 4-19
GEOLOGIC FENCE DIAGRAM
LOAD LINE 5

Abandoned Burning Ground

Monitoring wells were installed surrounding the burning ground at the four corners. Figure 4-20 is a fence diagram showing the soil make-up of this area based on the drillers' bore logs of G-5, G-6, G-7 and G-8. The burning ground is located between the main channel of Silver Creek (about 200 feet to the west of G-5) and an intermittent tributary (about 100 feet to the east of G-7). The surface horizon is a black to dark grey organic clay to one-foot. Below this, at the northwest corner (G-5), a dark greyish brown stiff silty clay grades to a light yellowish brown silty clay at 7 feet, which continues down to a depth of 13.5 feet. Between 13.5 and 17 feet, a dark grey clayey loose silt is found. Below 17 feet, the loose sand of the underlying alluvium extends to a bore depth of 30.5 feet. Toward G-7 in the southeast corner, the silty clay horizon thins and changes laterally to a light yellowish brown loose clayey silt to a depth of 13 feet. The clays grade-out vertically around 8 feet, and sand is encountered at 13 feet to a bore depth of 30.5 feet. The sand becomes coarser with depth. At G-8 in the southwest corner of the grounds, a second clay horizon is encountered at 35 feet, described as a dark grey, low plasticity silty clay which is similar to the clay horizon encountered above.

Ammonium Nitrate Area

The ammonium nitrate production area is bounded by monitoring Wells G-29, G-30 and G-31 on the north, northeast corner, and east boundaries, respectively. A fence diagram (Figure 4-21) shows a relatively thin silty clay upper horizon extending to 5.5 feet at G-29 to 3 feet at G-31, but grades to the sandy alluvium laterally at G-30 in the northeast. The sandy alluvium extends to at least a bore depth of 35.5 feet.



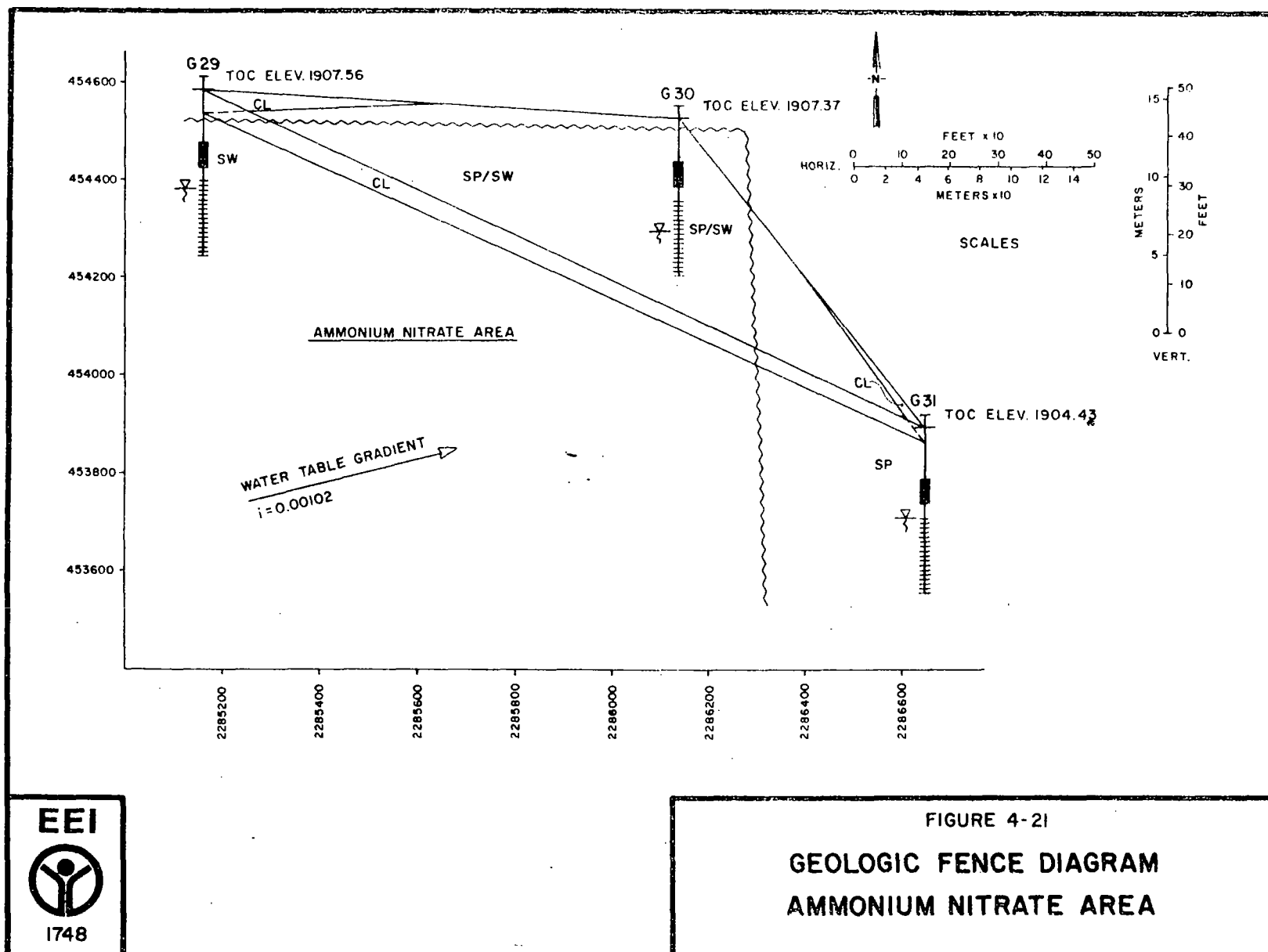


FIGURE 4-21
GEOLOGIC FENCE DIAGRAM
AMMONIUM NITRATE AREA

CHAPTER 5

GROUNDWATER

WATER TABLE DETERMINATION

Water levels in the 33 monitoring wells installed at CAAP were measured immediately prior to purging the wells during the sampling procedure. The water level measurements were made between January 6 and January 12, 1982. These measurements are shown in Table 5-1. Other information regarding details of the construction of the wells are included in Table 2-1.

The water level measurements were entered into the Groundwater Stabilized file in the Data Management System, and a water table contour plot was generated using the Geo Contour plotting program. This plot is included as Figure 5-1. This plot indicates that the general direction of groundwater flow at CAAP is to the northeast. The variation from this northeast groundwater flow direction shown in the southwestern portion of the plant is probably due to the lack of data points in this area.

GROUNDWATER FLOW DIRECTIONS

As shown by Figure 5-1, the water table gradient throughout CAAP is relatively uniform, ranging from a high of 0.0017 (0.17 percent) to a low of 0.0007 (0.07 percent). These gradients are low probably because of the permeable nature of the soils and the low topographic relief in the general vicinity of CAAP. The horizontal coefficient of permeability of some of the more permeable gravel zones is reported to be as high as 670 feet per day¹ (2×10^{-1} cm/sec). The low topographic relief combined with the permeable soils also suggests that a relatively high percentage of the precipitation soaks into the ground and recharges the shallow aquifer. This is especially true in the eastern portion of the plant where the permeable sands crop out at the surface (Figure 4-2).

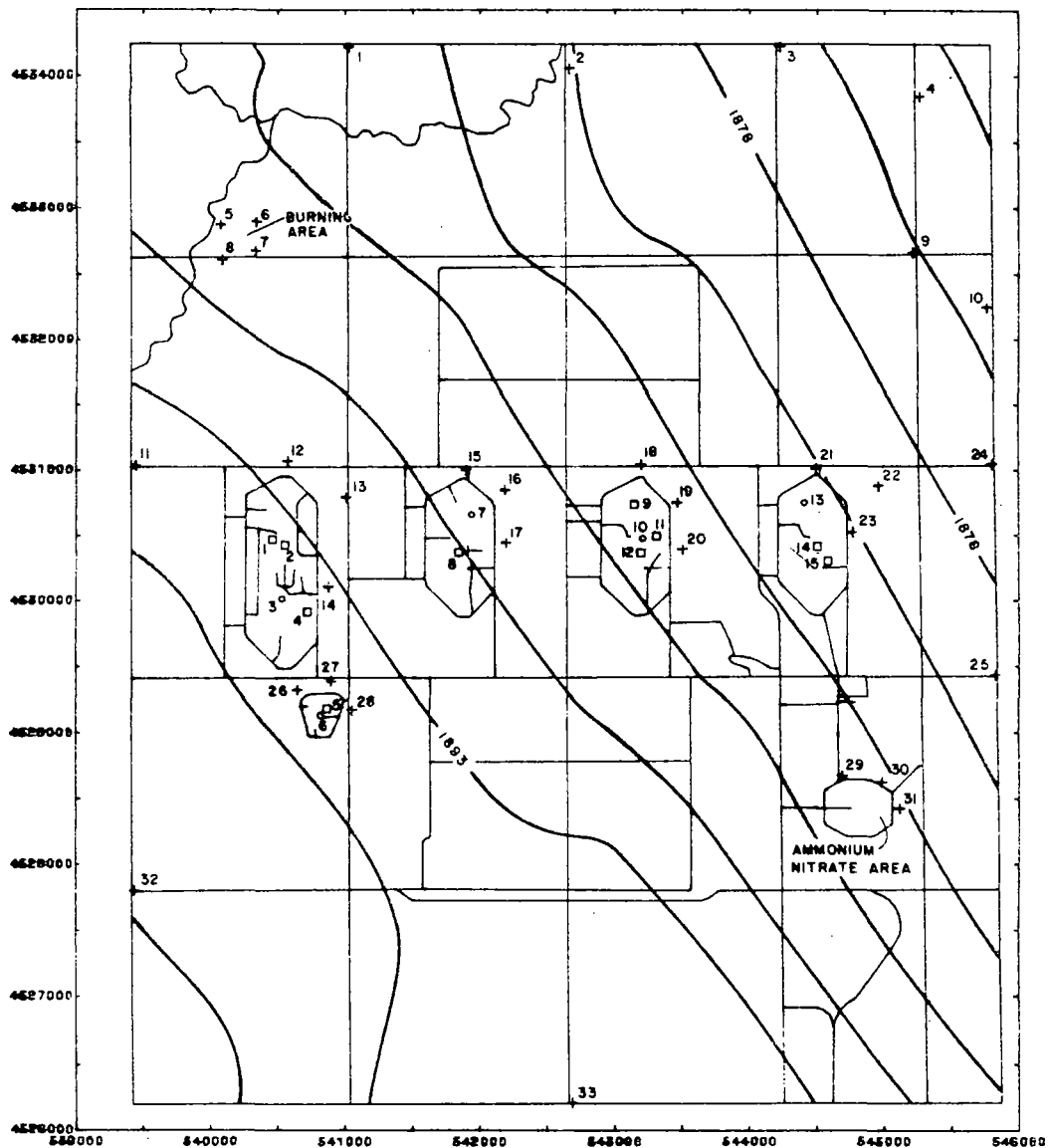
Except for the water supply wells, there are apparently no major groundwater discharge areas at CAAP. This means that there is diffuse groundwater recharge occurring throughout the plant. There probably is, therefore, a slight vertical component to the direction of groundwater flow in the down direction throughout the plant. This vertical component of the flow vector is

¹Bureau of Reclamation, Grand Island, Nebraska, Personal Communication, March 15, 1982.

TABLE 5-1

WELL WATER LEVEL MEASUREMENTS

Well No.	Groundwater Depth From Ground Surface (ft)	Elevation of Groundwater (ft)	Date of Measurement
G1	14.23	1885.47	1/12/82
2	15.96	1880.58	1/12/82
3	15.65	1875.52	1/12/82
4	17.00	1872.63	1/12/82
5	15.42	1888.35	1/10/82
6	12.96	1887.57	1/10/82
7	13.71	1887.82	1/10/82
8	14.81	1888.76	1/10/82
9	16.96	1874.58	1/12/82
10	14.75	1873.65	1/12/82
11	16.35	1893.79	1/08/82
12	17.60	1891.55	1/07/82
13	18.50	1891.03	1/08/82
14	19.73	1892.74	1/08/82
15	19.62	1888.15	1/07/82
16	20.58	1887.56	1/07/82
17	19.41	1888.49	1/07/82
18	18.96	1884.55	1/07/82
19	19.67	1884.22	1/07/82
20	20.88	1884.67	1/07/82
21	17.25	1880.49	1/06/82
22	17.27	1879.10	1/06/82
23	18.52	1880.48	1/07/82
24	17.75	1875.58	1/06/82
25	18.88	1878.91	1/06/82
26	23.18	1894.37	1/08/82
27	23.67	1893.81	1/08/82
28	21.96	1893.64	1/08/82
29	20.07	1884.83	1/06/82
30	21.12	1883.48	1/06/82
31	18.15	1883.53	1/06/82
32	30.17	1898.20	1/08/82
33	20.33	1894.40	1/08/82



○ CESSPOOL
 □ LEACHING PIT
 +12 MONITORING WELL LOCATION AND NUMBER

CONTOUR INTERVALS = 3 FEET



FIGURE 5-1

WATER TABLE CONTOUR PLOT

probably stronger in the vicinity of the sandy soil outcrop band, and slightly lower in the western portion of the plant where the surficial fine grained soils are generally thicker.

GROUNDWATER FLOW/CONTAMINANT MIGRATION VELOCITIES

With few exceptions, the soils encountered below the water table were poorly graded permeable sands. Without conducting at least a grain size analysis on samples of this sand, it is impossible to accurately estimate the coefficient of permeability of this material. The Bureau of Reclamation office in Grand Island, Nebraska has estimated that the average horizontal coefficient of permeability of the shallow sand and gravel aquifer in the vicinity of CAAP is 200 feet per day (7×10^{-2} cm/sec), with individual sand or gravel seams ranging from 67 feet per day (2×10^{-2} cm/sec) up to 670 feet per day (2×10^{-1} cm/sec). These estimates are based on well tests for wells completed in the shallow aquifer. As stated in Chapter 4, the soils appear to become coarser with depth. Since the monitoring wells at CAAP are water table wells, these shallower sands may be somewhat less permeable than the soils typically encountered in water supply wells in the area. Based on the Bureau of Reclamation estimates, EEI suggests that these shallower sands may have a coefficient of permeability as low as 24 feet per day (8.5×10^{-3} cm/sec). David and DeWiest (1966)² consider this to be representative of the coefficient of permeability of a well sorted (poorly graded) very fine sand.

Table 5-2 summarizes the water table gradient information as measured on Figure 5-1, and calculates minimum and maximum groundwater flow velocities using the above estimates for each of the soil sampling sites. This table also summarizes the minimum and maximum horizontal contaminant migration distances based on the velocities shown and records of when the cesspools and leaching pits (where the soil sampling sites are located) were first put into use.

SUITABILITY OF MONITORING WELL LOCATIONS

The fifteen leaching pits/cesspools, the burning ground and the ammonium nitrate area shown on Figure 5-1 are all potential sources of groundwater contamination. The schematic cross

²Davis, S. N. and DeWiest, R. J. M., 1966. Hydrogeology, New York: John Wiley and Sons, Inc.

TABLE 5-2
GROUNDWATER FLOW VELOCITIES SUMMARY

Soil Sampling Site	Water Table Gradient (i)	Maximum Probable Velocity ¹ (ft/day)	Minimum Probable Velocity ² (ft/day)	Migration Time (yrs)	Horizontal Migration Maximum (ft)	Distance, Minimum ³ (ft)
S1	0.0015	3.01	0.11	40	44,019	1606
S2	0.0015	3.01	0.11	16	17,606	642
S3	0.0015	3.01	0.11	16	17,606	642
S4	0.0015	3.01	0.11	40	44,019	1606
S5	0.00071	1.43	0.05	15	7,816	274
S6	0.00071	1.43	0.05	40	20,840	730
S7	0.0017	3.42	0.12	40	49,973	1752
S8	0.0017	3.42	0.12	16	19,989	701
S9	0.0016	3.22	0.11	14	16,448	562
S10	0.0016	3.22	0.11	16	18,798	642
S11	0.0016	3.22	0.11	15	17,624	602
S12	0.0016	3.22	0.11	40	46,996	1606
S13	0.0012	2.42	0.087	40	35,300	1270
S14	0.0012	2.42	0.087	29	15,420	921
S15	0.0012	2.42	0.087	29	15,420	921
Ann. N. Area	0.00102	2.05	0.074	40	30,023	1079
Burn. Ground	0.00084	1.70	0.061	40	24,724	890

¹K = 670 ft/day = 1.6×10^{-1} cm/sec

²K = 24 ft/day = 8.5×10^{-3} cm/sec } and

³until 1982

$$V = \frac{Ki}{n} \text{ where } n = 0.35 \text{ (sand)}$$

sections in Chapter 4 show that there is less than 3.5 feet of fine grained soils between any of the bottoms of the cesspools/leaching pits and the underlying permeable sandy alluvium. If it is assumed that the amount of time necessary for contaminants to leach down to the water table is negligible, then the theoretical horizontal contaminant migration rate can be calculated. This calculation is summarized in Table 5-2.

The time for contaminants to theoretically start to migrate from these potential sources is based on the date the source was first put into operation. The Migration Time column shown on Table 5-2 is based on the time elapsed between the date the potential source was first put into operation and 1982. The distances the contaminants in these sources have theoretically migrated from their sources depends on the rate of groundwater movement. The theoretical maximum and minimum migration distances shown on Table 5-2 have been calculated using the maximum and minimum velocities. These velocities are based on the maximum coefficient of permeability estimated by the Bureau of Reclamation office in Grand Island, Nebraska and the minimum coefficient of permeability derived from Davis and DeWeist (1966).

In order to demonstrate that a potential source has not contaminated groundwater, a monitoring well must be down-gradient from the source, installed at the proper depth, and close enough to the source to be within the theoretical contaminant plume.

Based on the preceeding discussion, it appears that virtually the entire site can be considered a groundwater recharge area, with vertical gradients very slight and in the down direction. With some downward component to the groundwater flow vector, the potential exists for contaminants to be driven below the water table after several years of movement. At an average recharge rate of two inches (5 centimeters) per year³, the contaminants might be as deep as 19 feet (six meters) below the water table after 40 years of movement (assumes no vertical dispersal and a porosity of 35 percent). Since most of the monitoring wells tap strata at least 15 feet below the water table, and since some vertical diffusion probably occurs, it appears that the depth of the monitoring wells at CAAP is appropriate for monitoring the potential sources of contamination.

³ Bureau of Reclamation, Grand Island, Nebraska, Fred Otradovsky, personal communication, March 23, 1982.

Figure 5-1 shows the orientation of the monitoring wells with respect to both the water table contours and the potential sources of contamination. As shown in this figure, several of the potential sources of contamination do not have monitoring wells directly downgradient from them. The cesspools and leaching pits are very small when plotted to scale on this figure, and would act essentially as point sources of contamination.

The shallow, sandy alluvial aquifer would have a low tendency to disperse contaminants laterally (i.e. much lower than a limestone or basalt aquifer). Geraghty and Miller (1980)⁴ describe a point source contaminant plume in a sand and gravel aquifer. This plume could be roughly described by a 20° arc with its center of rotation at the source. If a similar configuration is assumed for the theoretical contamination plumes at CAAP, all of the cesspools and leaching pits (except cesspool 13) would have a monitoring well within their theoretical plumes.

These theoretical contaminant plumes have a limited extent in the downgradient direction as discussed earlier. The maximum and minimum horizontal migration distances shown in Table 5-2 define these limits. If the maximum distance is used, all of the potential contaminant sources (except cesspool 13) have at least one monitoring well within their respective theoretical contaminant plumes. If the minimum migration distance is used, most of the sources do not have any monitoring wells within their theoretical contaminant plumes. These relationships are summarized in Table 5-3.

CONCLUSIONS AND RECOMMENDATIONS

Since most the sources do not have any monitoring wells within the minimum contaminant migration distance, it will not be possible to conclude that these sources are not contaminating or have not contaminated groundwater. If the wells within the maximum contaminant migration distances indicate the presence of some contamination, then this contamination may have originated at the respective source. However, identifying the source of contamination at any given well may be difficult. At Table 5-3 shows, the same well may fall within several potential contamination plumes.

⁴Geraghty and Miller, Inc., "The Fundamentals of Ground-Water Quality Protection Seminar," May 19-20, 1980, Chicago, Illinois.

TABLE 5-3
DOWNGRAIDENT MONITORING WELLS

Monitoring Wells Within:

<u>Source</u>	<u>Minimum Migration Distance</u>	<u>Maximum Migration Distance</u>
S1	None	3,4,13
2	None	3,4,13
3	None	9,15,16
4	14	4,9,14,15,16
5	None	17
6	None	9,10,17,18,19,21
7	16	4,9,16
8	None	9,10,18
9	None	9,10
10	None	10
11	None	10,21
12	None	10,21
13	None	None
14	23	22,23,24
15	23	23,24
Ammonium Nitrate Area	29,30,31	25,29,30,31
Burning Area	6	2,6

The information shown in Table 5-3 is based on very little site specific data or measurements. Neither of the two estimates of the coefficient of permeability are based on site specific measurements, and the estimate of the angle of lateral dispersion is based on only one case study of a contaminant plume in a similar geologic setting. Because of the inherent uncertainty in these estimates, EEI does not believe that this information alone is sufficient justification to recommend the installation of additional monitoring wells. EEI suggests that if these estimates are confirmed by results of the sampling and analysis program (i.e. most wells show no contamination) and the aquifer testing, the installation of additional wells is recommended. These additional wells would be necessary to demonstrate that the potential sources have not and/or are not contaminating groundwater at CAAP.

APPENDIX A
SOIL BORING LOGS

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G-1DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 18.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-9-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-9-81DATE BORING COMPLETED 11-9-81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
		OH	Dark Brown Clayey Top Soil, w/ organic Sharp	12/12	S-1	0 sample S-1 Taken from auger
		CH	Olive Gray highly plastic clay, stiff moist, no free water 5/2-5Y Fluvial		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
					4.0	
	5			12/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					5.5	
					9.0	Protective casing not set at this time-not available Center plug of auger not used from 20 to 35 ft. 80 gals water used as follows:
	10				8.3	20-20 gal. 25-20 gal. 30-20 gal. 35-20 gal.
					10.5	
			Sharp			Grant mixed and pumped into hole Hole cased at 19.5 ft.
			Dark olive gray clayey loose silt, w/10-15% clay moist no free water.		14.0	
	15	SM	3/2-5Y	12/18	S-4	Free water encountered at 18.0 ft.
		ML	Fluvial		15.5	Free water observed in sample S-5
			Sharp			
		SP	Dark Gray fine sand free water loose 4/1 5Y		19.0	
	20		Fluvial	18/18	S-5	

20.5

PROJECT CAAPBORING G-1

PROJECT CAAPBORING NO. G-1DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 18.0DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOV ERY	BOX OR SAMPLE NO	REMARKS
		SP	Becoming medium to coarse in size w/1-2% pea gravel at 23.0 ft.		24.0	
	25			18/18	S-6	D
					25.5	
			Becoming coarse in size w/1-2% pea gravel at 28.0 ft.		29.0	
	30	SP		18/18	S-7	D
					30.5	
					34.0	
	35			12/18	S-8	D
			T.O. 35.5 ft.		35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-1

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G-2DRILLING CONTRACTOR SWIFIRST ENCOUNTERED WATER DEPTH 13.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-12-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-12-81DATE BORING COMPLETED 11-12-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Dark Grayish Brown clayey top soil with organic (Sharp)	2/12	S-1	0 sample S-1 Taken from auger
		CL	Light yellowish brown low plasticity, silty stiff clay, moisture free water, highly jointed 6/4-2.5Y Fluvial		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
	5				4.0	
				18/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					5.5	
					9.0	
	10		Sharp	12/18	S-3	P Protective casing was not placed at this time because it was not available.
		ML	Light yellowish brown firm silty, no apparent bedding, moist no free water Fluvial 6/4-2.5Y		10.5	Center plug of auger was not used from 25 to 30 ft.
			Sharp		14.0	20 gals. water used to advance auger from 25 to 30 ft.
	15		Light yellowish brown fine sand, loose w/free water Fluvial 6/4-2.5Y	7/18	S-4	P P.V.C. fell about 1 ft. when augers were pulled.
			Augers started drill very easy at 13.0 ft. indicating ground water. Also free water observed in sample S-4		15.5	Cement hand mixed and poured into hole because we only had to grout 5.25 ft.
					19.0	Hole caved to 24 ft.
	20			12/18	S-5	P

20.5

PROJECT CAAPBORING G-2

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAP

BORING NO. G-2

DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH

DRILLER'S NAME Kraft

DATE ENCOUNTERED

GEOLOGIST NAME Sneed

GROUND ELEVATION

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED

DATE BORING COMPLETED

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
		SW	Become a light gray, loose, fine to coarse sand at 19.0 ft. w/1-2% pea gravel M7/-2.5Y Fluvial			
	25		Grading to a very fine light gray loose sand w/a few gray loose silt seam 3 to 4 inches thick between 20 & 20 Ft. N7/-2.5Y Fluvial	18/18	S-6	P
					24.0	
					25.5	
	30			18/18	S-7	
					29.0	
			T.D. 30.5		30.5	
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAP

BORING G-2

PROJECT CAAPBORING NO. G-3PAGE 2DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 13.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-12-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-12-81DATE BORING COMPLETED 11-12-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
			Dark Brown clayey Top Soil with organic	12/12	S-1	0 sample S-1 Taken from auger
			Sharp		1.0	Measurement Depths - Ft. Samples - In. Recovery -In./In. All samples taken w/split spoon
		CL	Light yellowish brown stiff, low plasticity, silty clay with iron stains 6/4-2.5Y Moist, no free water Fluvial		4.0	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
	5		Sharp	18/18	S-2	Protective casing was not placed at this time because it was not available.
			Light yellowish brown, loose very fine sand moist, no free water		2.0	
	10		Fluvial 6/4-2.5Y	18/18	S-3	P Center plug of augers was not used from 15 to 30 ft.
			W/1-2% gravel		0.5	80 gals of water was used as follows: 15-20 gal. 20-20-gal. 25-20 gal. 30-20 gal.
			Free water encountered at 13.0 ft. Cuttings from auger were wet and free was in sample S-4	6/18	4.0	
	15			6/18	S-4	P P.V.C. dropped about 1" where augers were pulled.
					5.5	Grout was hand mixed and poured because we only had 4' to grout
					4.0	Hole caved to 16.5 ft.
	20			6/18	S-5	D

20.5

PROJECT CAAPBORING G-

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING N. G-3DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVER ERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25	SW	Gray, loose, fine to coarse sand w/ a few sand gray clay seams 4 to 5 inch thick N5/-2.5Y Fluvial	18/18	S-6	n
					25.5	
					29.0	
	30		T.D. 30.5		S-7	
					30.5	
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-3

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G- 4DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 18.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-9-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-9-81DATE BORING COMPLETED 11-9-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Dark brown clayey top soil w/organics sharp moist	12/12	S-1	0 sample S-1 Taken from auger
		ML	Light yellowish brown clayey silt loose 10-15% clay Dry 6/4-2.5Y Fluvial		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
	5				4.0	
			Sharp	18/12	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
		SP	Light yellowish brown loose fine sand w/1-2% pea gravel moist no free water 6/4-2.5Y Fluvial		5.5	
	10				9.0	Protective casing not placed at this time because it was not available.
				2/18	S-3	
					0.5	P.V.C. dropped about 1 ft. when augers were pulled.
					14.0	Center plug not used from 20 to 35 feet
	15			12/18	S-4	80 gals. water used as follows: 20-20 gal. 25-20 gal. 30-20 gal. 35-20 gal.
			Free water encountered at 18.0 ft.		5.5	
			Free water observed in sample S-5			Hole caved at 19.5 ft.
					9.0	
	20				S-5	

20.5

PROJECT CAAPBORING G- 4

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING NO. G-4DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25		Becoming medium to coarse in size at 25.0	4/16	S-6	D
					25.5	
					29.0	
	30			12/18	S-7	D
					30.5	
					34.0	
	35		TD 35.5	No Sample	S-8	D
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-4

BORING LOG PAGE 1 OF 2 PAGE

PROJECT CAAP BORING NO. G- 5

DRILLING CONTRACTOR SWL FIRST ENCOUNTERED WATER DEPTH 35

DRILLER'S NAME Kraft DATE ENCOUNTERED 11-10-81

GEOLOGIST NAME Speed GROUND ELEVATION

RIG MAKE/ MODEL CME-55 GEOLOGIST'S SIGNATURE

DATE BORING STARTED 11-10-81 DATE BORING COMPLETED 11-10-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
			Black to dark gray clayey top soil with organics	12/12	S-1	0 sample S-1 Taken from auger
			Sharp		1.0	Measurement
			Dark grayish brown stiff silty clay highly jointed 20-25% silt moisture free water 4/2-2.5Y			Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
		CL	Fluvial Low plasticity		4.0	
	5			18/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer)
			Light yellowish brown stiff silty clay, highly jointed 20-25% silt moist, no free water 6/4-2.5Y		5.5	Hole Drilled w/11" O.D 6 6" I.D. H.S.A.
			Fluvial Low Plasticity		9.0	Protective casing not placed at this time. P.V.C. dropped about 1 ft. when augers were pulled.
	10			18/18	S-3	Center plug at augers not used 15 to 30 feet.
					0.5	80 gals water used as follows: 15-20 gal. 20-20 gal. 25-20 gal. 30-20 gal.
			Dark gray, clayey loose silt, 15-20% clay w/4% fine sand seam every 1 ft.		14.0	Grout hand mixed and poured in hole because it is not available
	15	ML	N41-7.5YR Fluvial Free water encountered at 13.5 ft.	18/18	S-4	Hole caved in at 16.0 ft.
					05.5	Method of obtaining sample
			Gray fine loose sand with 1 to 2% pea gravel N 6/0 7.5 YR			Free water observed in sample S-4
		SP	Fluvial		9.0	
	20			12/18	S-5	

20.5

PROJECT CAAP BORING G- 5

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING N. G-5DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 13.5DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVER ERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25			18/18	S-6	
					25.5	
					29.0	
	30			No Sample	S-7	
			T.D. 39.5		30.5	
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-5

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G-6DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME KraftDATE ENCOUNTERED 11-10-81GEOLOGIST NAME Speed

GROUND ELEVATION _____

RIG MAKE/ MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-10-81DATE BORING COMPLETED 11-10-81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black to very dark gray clayey top soil w/ organics	12/12	S-1	0 sample S-1 Taken from auger
			Sharp		1.0	Measurement Depths - Ft.
			Light yellowish brown silt clay, stiff, highly jointed moist no free water 6/4-2.5Y Fluvial			Samples - In.
					4.0	Recovery - In./In.
						All samples taken w/split spoon
	5	CL		19/18	S-2	All samples in Plastic bags
			Sharp		5.5	Method of taking samples
	6		Dark olive gray soft, clayey silt, moist, no free water 3/2 - 5Y			Pushed - P
			Fluvial			Driven w/ - D (40#hammer)
		SM			9.0	Hole Drilled w/11" O.D & 6" I.D. H.S.A.
		ML		19/18	S-3	
	10				0.5	Note- Could not get P.V.C. pipe to go out the bottom HSA due to clay plug. Tried to pull P.V.C. and the screen pulled off. Back filled hole with sand to 13.0 feet. Grouted hole from 13.0 feet to 2.0 ft. Redrilled 10 ft. to the south.
			Gray loose fine to medium sand w/free water H5/-2.5Y Fluvial		14.0	
	15		W/1-2% pea gravel	2/18	S-4	
					15.5	
					19.0	
	20			2/18	S-5	

20.5

PROJECT CAAPBORING G-6

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAP

BORING NO. G-6

DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH

DRILLER'S NAME Kraft

DATE ENCOUNTERED

GEOLOGIST NAME Sneed

GROUND ELEVATION

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED

DATE BORING COMPLETED

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOV ERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25			18/18	S-6	
					25.5	
					29.0	
	30		Sharp Gray silty, stiff clay w/10% silt H3/-2.5Y Fluvial T.D. 30.5	18/18	S-7	
					30.5	
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAP

BORING G-6

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAP

BORING NO. G-7

DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH 13.0

DRILLER'S NAME Kraft

DATE ENCOUNTERED 11-11-81

GEOLOGIST NAME Sneed

GROUND ELEVATION

RIG MAKE / MODEL CMF-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED 11-11-81

DATE BORING COMPLETED 11-11-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black to dark gray top soil with organic moist	12/12	S-1	0 sample S-1 Taken from auger
			Sharp		1.0	Measurement
			Light yellowish brown loose clayey silt w/20-25 clay moist, no free water			Depths - Ft.
		ML	6/4-2.5Y Fluvial		4.0	Samples - In.
						Recovery - In./In.
						All samples taken w/split spoon
	5			13/18	S-2	All samples in Plastic bags
					5.5	Method of taking samples
						Pushed - P
						Driven w/ - D (40#hammer)
						Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					9.0	Grout was hand mixed and poured into the hole rather than pumped because we only had 4.5 feet to grout.
	10		Becoming less clayey at 8.0, 10-15% clay	18/18	S-3	Protective casing was not placed at this time. It has not arrived on site as yet.
					10.5	
					14.0	
	15	SP	Gray loose fine sand, w/free water H5/-2.5Y Fluvial	6/18	S-4	Hole caved to 16.5 ft.
					15.5	
			Free water encountered at 13.0 ft. This water level was noted by the engineer of drilling, indicating sand.		19.0	
	20			No sample	S-5	Drove split spoon 18" w/140# hammer at S-5

20.5

PROJECT CAAP

BORING G-7

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING N. G-7DRILLING CONTRACTOR SWI.

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
						A total of 80.0 gallons of water was used to advance augers starting at 14.0 ft.
					24.0	20 gals. - 14'
					S-6	20 gals. - 19'
					25.5	20 gals. - 24'
					29.0	20 gals. - 29'
	25	SP	Becoming coarse in size at 27 to 28 feet w/1-2% pea gravel.	12/18		
						Drove split spoon 18" w/140# hammer at S-6
	30				S-7	
			TD 30.5		30.5	Drove split spoon 18" w/140# hammer at S-7
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-7

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAP

BORING NO. G-8

BORING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH

DRILLER'S NAME Kraft

DATE ENCOUNTERED 11-11-81

GEOLOGIST NAME Speed

GROUND ELEVATION

DRILL MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED 11-11-81

DATE BORING COMPLETED 11-11-81

DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
		Black to dark gray clayey top soil w/ organics	12/12	S-1	0 sample S-1 Taken from auger
		Sharp		1.0	Measurement
	CL	Light yellowish brown silty clay, highly jointed with low plasticity, stiff moist no free water silt 15 to 20% Fluvial origin	18/18	4.0	Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
5				S-2	All samples in Plastic bags
				5.5	Method of taking samples Pushed - P Driven w/ - D (40#hammer)
					Hole Drilled w/11" O.D & 6" I.D. H.S.A.
				9.0	Center plug was used to a depth of
10			18/18	S-3	From this point to the bottom of the hole the center plug was not used.
				0.5	P.V.C. was placed inside H.S.A.
				14.0	When auger pulled out P.V.C. fell about 1 ft. because of sand inside of augers.
15		Sharp	18/18	S-4	Grout hand mixed and poured in hole because we only had 8 ft. to grout.
	SM	Gray loose fine sand, w/free water H5-2.5Y Fluvial		15.5	Protective casing not placed at this time.
		Free was observed in the fine sand in lower part of sample S-4		9.0	Hole caved to 16.5 ft.
20			9/18	S-5	

20.5

PROJECT CAAP

BORING G-8

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAP

BORING N. G-8

DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH

DRILLER'S NAME Kraft

DATE ENCOUNTERED

GEOLOGIST NAME Sneed

GROUND ELEVATION

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED

DATE BORING COMPLETED

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
						100 gallons of water used to advance auger as follows: 20 gal. - 15 ft. 20 gal. - 20 ft. 20 gal. - 25 ft. 20 gal. - 30 ft. 20 gal. - 35 ft.
					24.0	
	25	ML	Dark gray loose clayey silt w/ 10-15% silt N 41-2.5Y Fluvial	18/18	S-6	Drove split spoon 18" w/140# hammer at S-6
					25.5	
			Light gray medium to coarse loose sand w/ 1-2% pea gravel N 7/- 2.5 Y Fluvial		29.0	
	30			No sample	S-7	Drove split spoon 18" w/140# hammer at S-7
					30.5	Had to advance augers to 35.5 ft. let top of screen down to 15 ft. due to sand in augers and caving sand.
					34.0	
	35	CL	Dark gray silty clay low plasticity, 15 to 20% silt Fluvial	18/18	S-8	Drove split spoon 18" w/140# hammer at S-8
					35.5	
			T.D. 35.5'		39.0	
	40					

40.5

PROJECT CAAP

BORING G-

BORING LOG PAGE 1 OF 2 PAGE

PROJECT CAAP BORING NO. G-9

DRILLING CONTRACTOR SWL FIRST ENCOUNTERED WATER DEPTH 14.0

DRILLER'S NAME Kraft DATE ENCOUNTERED 11-12-81

GEOLOGIST NAME Shard GROUND ELEVATION _____

RIG MAKE / MODEL CME-55 GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-12-81 DATE BORING COMPLETED 11-12-81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black to dark gray clayey top soil w/organics sharp	12/12	S-1	0 sample S-1 Taken from auger
			Light yellowish brown stiff, low plasticity silty clay, highly jointed dry to slightly moist 4/-2.5Y		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
			Fluvial Sharp		4.0	
			Light yellowish brown loose, very fine sand moist no free water 6/4 - 2.5Y	18/18	S-2	All samples in Plastic bags
			Fluvial		5.5	Method of taking samples Pushed - P Driven w/ - D (40#hammer)
					9.0	Hole Drilled w/11" O.D. & 6" I.D. H.S.A.
						Protective casing not placed at this time because it was not available.
	10			12/18	S-3	Center plug of auger was not used from 15 to 30 feet.
			w/1-2% pea gravel from 14.0' downward		0.5	80 gal. water used as follows: 15-20 gal. 20-20 gal. 25-20 gal. 30-20 gal.
			Free water observed in sample S-4 at about the middle of sample		14.0	P.V.C. dropped about 1 ft. when augers were pulled up.
	15			14/18	S-4	
					15.5	Grout was hand mixed and poured into hole because we only had 6 ft. to grout
						Hole caved to 16'
					9.0	
	20			12/18	S-5	
					20.5	

PROJECT CAAP

BORING G-9

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING NO. G-9DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/MODEL CMF-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25		Becoming medium to coarse w/1-2% pea gravel between 16 & 19 ft.	12/18	S-6	P
					25.5	
					29.0	
	30			No Sample	S-7	n
			T.O. 30.5		30.5	
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-9

BORING LOG PAGE 1 OF 2 PAGE

PROJECT CAAP BORING NO. G-10

DRILLING CONTRACTOR SWL FIRST ENCOUNTERED WATER DEPTH 13.0

DRILLER'S NAME Kraft DATE ENCOUNTERED 11-8-81

GEOLOGIST NAME Sneed GROUND ELEVATION _____

RIG MAKE/ MODEL CME-55 GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-8-81 DATE BORING COMPLETED 11-8-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
			Black to dark gray clayey top soil w/ organic moist	2/12	S-1	0 sample S-1 Taken from auger
		SM ML	Sharp Light yellowish brown loose clayey silt 10-15% clay Dry 6/4-2.5Y Fluvial		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
			Sharp		4.0	
		SP	Light yellowish brown loose fine sand with 1-2% pea gravel moist no free water Fluvial 6/4-2.5Y	12/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					5.5	
					9.0	Protective casing not set at this time because it was not available. P.V.C. dropped about 1 ft. when augers were pulled Center plug of augers not used from 15 to 30 ft.
	10			12/18	S-3	P
					10.5	
			Free water encountered at 13.0 Free water observed in sample S-4		14.0	No water used. Grout hand mixed and poured into hole.
	15			6/18	S-4	P
					15.5	
					19.0	
	20			12/18	S-5	P

20.5

PROJECT CAAP BORING G-10

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING N. G-10DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 13.0DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25			12/18	S-6	D
					25.5	
					29.0	
	30				S-7	D
			T. D. 30.5		30.5	
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-10

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAP

BORING NO. G-11

DRILLING CONTRACTOR SWI.

FIRST ENCOUNTERED WATER DEPTH 14-0

DRILLER'S NAME Kraft

DATE ENCOUNTERED 11-13-81

GEOLOGIST NAME Sneed

GROUND ELEVATION

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED 11-13-81

DATE BORING COMPLETED 11-13-81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Dark brown, clayey silty top soil with organic sharp	12/12	S-1	0 sample S-1 Taken from auger
		CL			1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
					4.0	
	5		Very dark grayish brown silty, stiff low plasticity highly jointed moist clay. No free water 3/2-10Y Fluvial	18/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer)
				18/18	5.5	Hole Drilled w/11" O.D. & 6" I.D. H.S.A.
					9.0	Protective casing not placed at this time because it was not available. Center plug of augers 15 to 30 ft P.V.C. dropped about 1 ft. when auger were pulled. Grout was hand mixed and poured into hole because we only had 5.5 feet to grout.
	10	SP	Light yellowish brown very fine sand loose moist, no free water 6/4-2.5Y Fluvial	18/18	S-3	
					0.5	
					4.0	80 gals. water use as follows: 15-20 gals. 20-20-gals. 25-20-gals. 31-30-gals.
	15	SW	Becoming between 11 & 14 ft. A gray fine, loose sand w/1-2% pea gravel N5/-2.5Y Fluvial	18/18	S-4	
					5.5	Hole caved to 15 ft.
					9.0	Hole drilled with 11" O.D. & 6" I.D. Augers
	20			No samp	S-5	

20.5

PROJECT CAAP

BORING G-11

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING NO. G-11DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Become medium to coarse in size between 16 to 19 ft.		24.0	
	25			No Sample	S-6	
					25.5	
					29.0	
	30			12/18	S-7	
			T.D. 30.5'		30.5	
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-11

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAMPBORING NO. G-12DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 14.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-13-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-13-81DATE BORING COMPLETED 11-13-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Dark brown silty clayey top soil with organics Sharp	12/12	S-1	0 sample S-1 Taken from auger
		CL	Olive, silty, stiff moist, clay with iron stains, no free water 5/4-5Y Fluvial Low plasticity		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
	5				4.0	
				18/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					5.5	
	10	SP	Light yellowish brown fine, loose, sand with free water 6/4-2.5Y Fluvial		9.0	Protective casing not placed at this time because it was not available.
				18/18	S-3	P Center plug of augers not used from 15 to 30 ft
					0.5	80 gal. water used as follows: 15-20 gal. 20-20 gal. 25-20 gal. 30-30 gal.
			Free water observed in sample S-3		14.0	P.V.C. dropped about 1 ft. when augers were pulled.
	15			12/18	S-4	P Grout was hand mixed and poured into hole because we only had 1 ft. to grout
					15.5	
					19.0	Hole caved to 14.5 ft.
	20		Becoming a gray, loose fine sand, w/1-2% pea gravel between 16-19 ft.	18/18	S-5	P

20.5

PROJECT CAMPBORING G- 12

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING N. G-12DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 14.0DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25			8/18	S-6	D
					25.5	
			Sharp			
		CL			29.0	
	30		Dark gray silty, stiff, clay, 4/1-5Y Low plasticity Fluvial		S-7	D
			T.D. 30.5		30.5	
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-12

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. C-13DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME KraftDATE ENCOUNTERED 11-14-81GEOLOGIST NAME Speed

GROUND ELEVATION _____

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-14-81DATE BORING COMPLETED 11-14-81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Dark Brown, moist silty clayey top soil w/organics Sharp	12/12	S-1	0 sample S-1 Taken from auger
			Light yellowish brown silty, low plasticity moist clay, 20-25% sil 6/4-2.5Y Fluvial		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
		CL	No free water with a few very thin fine sand seams at one inch thick.		4.0	
	5			18/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer)
					5.5	Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					9.0	Protective casing not placed at this time because it was not available.
	10			18/18	S-3	P.V.C. dropped about one ft. where auger was pulled.
					0.5	
		SP	Light yellowish brown loose, fine sand moist no free water 6/4-2.5Y Fluvial		14.0	Center plug of augers not used from 20 to 35 ft.
	15					80 gals. water used as follows: 20-25 gal. 25-30 gal. 30-35 gal. 35-40 gal.
			Free water encountered at 18.0 ft. cuttings from auger were very wet and free water from samples - 5 was observed.	12/18	S-4	Grout was hand mixed and poured into hole we only had to grout 10.0 ft.
			Sand becoming high gray in color at 18.0 ft. 6/1-5Y		15.5	
					19.0	Hole caved to 19.0 ft.
	20			12/18	S-5	

20.5

PROJECT CAAPBORING C-13

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAP

BORING NO. G-13

DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH

DRILLER'S NAME Kraft

DATE ENCOUNTERED

GEOLOGIST NAME Sneed

GROUND ELEVATION

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED

DATE BORING COMPLETED

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
		SW	Becoming fine to medium in size between 21 & 24 ft.			
					24.0	
	25			12/18	S-6	P
					25.5	
					29.0	
	30				S-7	
			T. D. 30.5 S		30.5	
					34.0	
	35				S-8	
					35.5	
					39.0	
	40					

40.5

PROJECT CAAP

BORING C-13

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAMPBORING NO. G-14DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-26-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-26-81DATE BORING COMPLETED 11-26-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black to dark brown clayey top soil w/ organics Sharp	12/12	S-1	0 sample S-1 Taken from auger
			Olive, stiff, moist silty clay w/20% silt, no free water 5/4 - 5Y Fluvial		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
		CL			4.0	
	5			18/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					5.5	
					9.0	Center plug of auger not used from 20 to 3" ft
	10		Sharp		5.3	50 gals. of water used to clean augers out at 35.5 ft.
				18/18		
			Light yellow, brown loose, silt, very fine sand, moist no free water 20% silt		0.5	P.V.C. dropped about ft. when augers were pulled.
		ML			14.0	
			6/4-2.5Y Fluvial Sharp			
	15			18/18	S-4	
		SP	Light yellowish brown loose fine sand w/1-2% pea gravel moist, no free water 6/4-2.5Y Fluvial Free noted on bit and sample S-5		15.5	
					19.0	
	20		Becoming fine to medium at 19 ft. Free water encountered at 20.0 ft.	12/18	S-5	

20.5

PROJECT CAMPBORING G-14

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING NO. G-14DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-26-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-26-81DATE BORING COMPLETED 11-26-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25	SP	Becoming gray in color at 25 feet N6/-2.5Y	18/18	S-6	D
					25.5	
					29.0	
	30		Becoming medium to coarse between 26 to 29 feet	18/18	S-7	D
					30.5	
					34.0	
	35			18/18	S-8	
			T.D. 35.5'		35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-14

PROJECT CAMPBORING NO. G-15DRILLING CONTRACTOR SWI.FIRST ENCOUNTERED WATER DEPTH 20'DRILLER'S NAME KraftDATE ENCOUNTERED 11-26-81GEOLOGIST NAME Speed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-26-81DATE BORING COMPLETED 11-26-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black to dark brown clayey top soil with organic	12/12	S-1	0 sample S-1 Taken from auger
			Sharp		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
			Olive stiff moist silty clay w/iron stain 25-30% silt, No Free water 5 1/4 - 5Y Fluvial		4.0	
	5	CL		18/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					5.5	
					9.0	Center plug and others not used from 20-35'
	10			18/18	S-3	
			Sharp		0.5	Used 30 gallon of water to advance auger as follows: 20 - 20 gal. 35 - 10 gal.
			Light yellowish brown loose very fine sand. Moist no free water 6/4-2.5Y Fluvial, with 1 1/2-2% pea gravel Free water observed on bit at 20' becoming medium to coarse between 16-19'		4.0	P.V.C. dropped about 1' when augers pulled.
	15	SP		14-18	S-4	Hole caved to
					5.5	
					9.0	
	20			12/18	S-5	

20.5

PROJECT CAMPBORING G-15

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAMPBORING NO. G-15DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 25DRILLER'S NAME KraftDATE ENCOUNTERED 11-26-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-26-81DATE BORING COMPLETED 11-26-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
					24.0	
	25		Becoming gray between 21-24' N6/2.5Y	18/18	S-6	D
					25.5	
					29.0	
	30			12/18	S-7	
					30.5	
					34.0	
	35			12/18	S-8	
			T.O. 35.5		35.5	
					39.0	
	40					

40.5

PROJECT CAMPBORING G-15

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAP

BORING NO. C-16

DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH 18.5

DRILLER'S NAME Kraft

DATE ENCOUNTERED 11/6-81

GEOLOGIST NAME Sneed

GROUND ELEVATION

RIG MAKE/ MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED 1-6-81

DATE BORING COMPLETED 11-6-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black to dark gray clayey topsoil with organics	12/12	S-1	0 sample S-1 Taken from auger
			Sharp		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
		ML	Light yellowish brown loose clay silt moist with no free water		4.0	
			6/4-2.5Y			All samples in Plastic bags
			Fluvial origin	18/18	S-2	Method of taking samples Pushed - P Driven w/ - D (40#hammer)
			10-15% clay		5.5	Hole Drilled W/11" O.D. & 6" I.D. H.S.A.
					9.0	Protective casing not placed at this time because it was not available.
	5			18/18	S-3	No water used
					0.5	
						Hole caved in at 19.5
			Sharp			
			Light yellowish brown with 1 to 2% pea gravel		4.0	
			Moist no free water 6/4-2.5Y	18/18	S-4	
			Fluvial origin		5.5	
	15					
			Free water encountered at 18.5 feet			
			Gradational		9.0	
	20			9/18	S-5	

20.5

PROJECT CAAP

BORING C-16

PROJECT CAAPBORING NO. G-16PAGE 2 OF 2 PAGEDRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
		SP	Light yellowish brown loose coarse sand w/1-2% pea gravel 10-15% fines with free water Fluvial origin 6/4-2.5Y			
	25			9/18	S-6	P
					24.0	
					25.5	
	30			No Sample	S-7	D
					29.0	
					30.5	
					34.0	
	35			12/18	S-8	D
					35.5	
			TO 35.5			
					39.0	
	40					

40.5

PROJECT CAAPBORING G-16

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAP

BORING NO. G-17

DRILLING CONTRACTOR SWI.

FIRST ENCOUNTERED WATER DEPTH 18.0

DRILLER'S NAME Kraft

DATE ENCOUNTERED 11-7-81

GEOLOGIST NAME Snel

GROUND ELEVATION

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED 11-7-81

DATE BORING COMPLETED 11-7-81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black to dark gray clayey top soil with organic, moist		S-1	0 sample S-1 Taken from auger
			Sharp		1.0	Measurement
			Light yellowish brown loose clayey silt 10-15% clay moist w/no free water 6/4 - 2.5Y		4.0	Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
	5			6/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
			Sharp		5.5	
			Light yellowish brown loose fine sand w/ 1 to 2% pea gravel. Moist no free water 6/4-2.5Y		9.0	
	10	SP	Fluvial origin	14/18	S-3	
					0.5	
			Grading fine in size to medium to coarse at about 18 ft.		14.0	
	15			12/18	S-4	
			Free water encountered at 18.0 feet.		5.5	
					9.0	
	20				S-5	

20.5

PROJECT CAAP

BORING G-

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING N. G-17DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 18.0DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/ MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVER ERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25			12/18	S-6	
					25.5	
					29.0	
	30			No sample	S-7	
					30.5	
					34.0	
	35			5/12	S-8	
			T O 35.5		35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-17

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G-18DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20'DRILLER'S NAME KraftDATE ENCOUNTERED 11-27-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-27-81DATE BORING COMPLETED 11-27-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
			Dark brown clay w/organic top soil	12/12	S-1	0 sample S-1 Taken from auger
			Sharp		1.0	Measurement
			Light yellowish brown loose silty sand with 20% silt moist			Depths - Ft.
			6/4-2.5Y Airborn			Samples - In.
						Recovery - In./In.
						All samples taken w/split spoon
					4.0	
	5	ML		18/18	S-2	All samples in Plastic bags
			Sharp		5.5	Method of taking samples
			Light yellowish brown stiff, moist, silty clay no free water.			Pushed - P
			6/4-2.5Y			Driven w/ - D
			Sharp			(40#hammer
						Hole Drilled
						W/11" O.D. &
						6" I.D. H.S.A.
						Center plug of auger is not used from 20-25
			Light yellowish brown loose, moist, fine sand 1 1/2-2% pea gravel		9.0	No water used to advance auger
			No free water			
			6/4-2.5Y	12/18	S-3	P.V.C. dropped about 1' when auger pulled
	10	SP			0.5	Hole caved to 18'
					14.0	
	15		Free water observed on the bit at 20'	12/18	S-4	
					15.5	
					19.0	
	20		No sample from 19-20 1/2		S-5	D

20.5

PROJECT CAAPBORING G-18

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING N. G-18DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME KraftDATE ENCOUNTERED 11-27-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-27-81DATE BORING COMPLETED 11-27-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVER ERY	BOX OR SAMPLE NO	REMARKS
			Becoming medium to coarse between 23' - 24'			
	25			18/18	S-6	D
					24.0	
					25.5	
	30			18/18	S-7	D
					29.0	
					30.5	
			No sample between 34-35½'		34.0	
	35				S-8	
			TD 35.5'		35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-18

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G- 19DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20DRILLER'S NAME KraftDATE ENCOUNTERED 11-27-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CHE-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-27-81DATE BORING COMPLETED 11-27-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black-Dark brown clayey top soil	12/12	S-1	0 sample S-1 Taken from auger
			Sharp		1.0	Measurement
			Olive, stiff, moist			Depths - Ft.
			silty clay 20-25% silt			Samples - In.
			5/6-5Y			Recovery -In./In.
			Fluvial			All samples taken w/split spoon
	5	CL			4.0	
				12/18	S-2	P All samples in Plastic bags
					5.5	Method of taking samples
						Pushed - P
						Driven w/ - D
						(40#hammer
						Hole Drilled
						w/11" O.D &
						6" I.D. H.S.A.
	10	SP	Light yellowish brown fine sand, moist no free water 1-2% pea gravel 6/4 - 2.5Y		9.0	Center plug of auger not used from 20 to 35ft.
			Fluvial			No water used to advance augers
				12/18	S-3	P
					0.5	P.V.C dropped about 1 ft. when augers were pulled.
						Hole caved to 19 ft.
	15				4.0	
			Becoming coarse to medium between 16-19'			
				12/18	S-4	P
					5.5	
					9.0	
	20			12/18	S-5	D

20.5

PROJECT CAAPBORING G-

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING N. G-19DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-27-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-27-81DATE BORING COMPLETED 11-27-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOV ERY	BOX OR SAMPLE NO	REMARKS
			Free water observed on the bit at 20'			
	25			18/18	24.0 S-6	
					25.5	
					29.0	
	30		Becoming grad at 30'	18/18	30.5 S-7	
					34.0	
	35			18/18	35.5 S-8	
			TD. 35.5			
					39.0	
	40					

40.5

PROJECT CAAPBORING G-19

PROJECT CAAPBORING NO. G-20DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-28-81GEOLOGIST NAME Speed

GROUND ELEVATION _____

RIG MAKE/ MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-28-81DATE BORING COMPLETED 11-28-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Brown clay with some organic top soil	12/12	S-1	0 sample S-1 Taken from auger
					1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
					4.0	
	5	CL	Olive silty clay with 20-25% silty moist with some iron stain 4/4-5Y	18/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer)
					5.5	Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					9.0	Center plug of auger not used from 20-35 ft.
	10			12/18	S-3	P No water used to advance augers
					0.5	Hole caved at 19.0 ft.
					14.0	P.V.C. dropped about 1 ft. when augers were pulled.
	15	SP	Light yellowish dark brown loose fine sand. Moist no free water 6/4-2.5Y	10/18	S-4	P
					5.5	
					9.0	
	20		Becoming medium to coarse with some pea gravel free water observed on the bit at 20'	8/18	S-5	

20.5

PROJECT CAAPBORING G-20

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING N. G-20DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-28-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-28-81DATE BORING COMPLETED 11-28-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOV ERY	BOX OR SAMPLE NO	REMARKS
			Becoming olive silty at 23' 5/6-5Y			
	25			18/18	24.0 S-6	D
					25.5	
	30			18/18	29.0 S-7	D
					30.5	
	35			18/18	34.0 S-8	D
			T.D. 35.5		35.5	
	40				39.0	

40.5

PROJECT CAAPBORING G-20

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAP

BORING NO. G-21

DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH 20.0

DRILLER'S NAME Kraft

DATE ENCOUNTERED 11-28-81

GEOLOGIST NAME Sneed

GROUND ELEVATION

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED 11-28-81

DATE BORING COMPLETED 11-28-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Top soil in black to dark brown clay sharp	12/12	S-1	0 sample S-1 Taken from auger
			Light yellowish loose moist fine sand 6/4-2.5Y No free water Fluvial		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
					4.0	
	5			18/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/1 1/2" O.D & 6" I.D. H.S.A.
					5.5	
					9.0	P.V.C. dropped about 1 ft when augers were pulled
	10		Becoming medium to coarse with some pea gravel	18/18	S-3	Hole caved at ft.
					0.5	
					14.0	
	15			12/18	S-4	
					5.5	
					19.0	
	20		Free water observed on the bit at 20' and on S-5	8/18	S-5	

20.5

PROJECT CAAP

BORING G-21

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING NO. G-21DRILLING CONTRACTOR SWI.FIRST ENCOUNTERED WATER DEPTH 20.0DRILLER'S NAME KraftDATE ENCOUNTERED 11-28-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 11-28-81DATE BORING COMPLETED 11-28-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
					24.0	
	25		Center plug not used from 20' - 35' No water used to advance the auger	10/18	S-6	D
					25.5	
					29.0	
	30			18/18	S-7	D
					30.5	
					34.0	
	35		T.D. 35.5	18/18	S-8	D
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-21

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G- 22DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20'DRILLER'S NAME KraftDATE ENCOUNTERED 12-2-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12-2-81DATE BORING COMPLETED 12-2-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Top soil is black to dark brown clay with some organic Sharp	12-12	S-1	0 sample S-1 Taken from auger
			Dark brown yellowish fine sand w/20 -25% silty moist loose, It has some iron stain 6/4-2.5V		1.0	Measurement Depths - Ft. Samples - In. Recovery -In./In. All samples taken w/split spoon
					4.0	
	5			12/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
			Sand encountered at 7'		5.5	No water used to advance augers
					9.0	P.V.C. dropped about 1ft. when augers were pulled.
	10			18/18	S-3	
					0.5	
			Fine light yellowish brown sand, moist loose		14.0	
	15			18/18	S-4	
					5.5	
			Becoming fine gray sand at 17' Free water observed on the bit at 20'		9.0	
	20			18/18	S-5	

20.5

PROJECT CAAPBORING G-22

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING N. G-22DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20'DRILLER'S NAME KraftDATE ENCOUNTERED 12-7-81GEOLOGIST NAME SneedGROUND ELEVATION RIG MAKE/ MODEL CME-55GEOLOGIST'S SIGNATURE DATE BORING STARTED 12-7-81DATE BORING COMPLETED

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Becoming to medium to coarse with some pea gravel			
					24.0	
	25		Center plug is not used on Sample 6	18/18	S-6	D
					25.5	
					29.0	
	30			18/18	S-7	D
					30.5	
					34.0	
	35			18/18	S-8	D
			T.D. 35.5		35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-22

PROJECT CAAP

BORING LOG

PAGE 3 OF 3 PAGEBORING NO. G-23DRILLING CONTRACTOR SWIFIRST ENCOUNTERED WATER DEPTH 20'DRILLER'S NAME KraftDATE ENCOUNTERED 12-2-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12-2-81DATE BORING COMPLETED 12-2-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black to dark brown clay with some organic Sharp	12/12	S-1	0 sample S-1 Taken from auger
			Olive gray silty clay with 20-25% silt moist, stiff 5/2-5Y No free water		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon 2"
					4.0	
	5			12/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer)
			Light yellowish brown fine sand loose moist 6/4-2.5Y Sand encountered at 7' No free water		5.5	Hole Drilled w/1" O.D & 6" I.D. H.S.A.
					9.0	No water used to advance augers.
	10			18/18	S-3	P P.V.C. dropped about 1 ft. when augers were pulled.
					0.5	Hole caved to
					14.0	
	15			18/18	S-4	P
					05.5	
			Free water observed on the bit at 20'			
					9.0	
	20			12/18	S-5	P

20.5

PROJECT CAAPBORING G-23

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING N. G-23DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20'DRILLER'S NAME KraftDATE ENCOUNTERED 12-2-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/ MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12-2-81DATE BORING COMPLETED 12-2-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVER ERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25		No sample between 24-25'	0/18	S-6	P
					25.5	
			Becoming medium to coarse with some pea gravel			
					29.0	
	30			12/18	S-7	D
					30.5	
					34.0	
	35			12/18	S-8	
			T.O. 35.5		35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-23

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G-24DRILLING CONTRACTOR SWI.FIRST ENCOUNTERED WATER DEPTH 20'DRILLER'S NAME KraftDATE ENCOUNTERED 12-3-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12-3-81DATE BORING COMPLETED 12-3-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
			Top soil black to dark brown clay, with some organic	12/12	S-1	0 sample S-1 Taken from auger
			Light yellowish brown fine sand. Moist loose 6/4-2.5Y		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
					4.0	
				12/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole drilled w/11" O.D & 6" I.D. H.S.A.
			Sharp Sand encountered at 8' depth		9.0	
			Becoming medium to coarse with some pea gravel at 15'	18/18	S-3	P No water used to advance augers. P.V.C. dropped about 1 ft. when augers were pulled. Hole caved to 12 ft.
					0.5	
					14.0	
			Free water observed on the bit at 20'	10/18	S-4	P
					05.5	
					9.0	
				18/18	S-5	D

20.5

PROJECT CAAPBORING G-24

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING N. G-24DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME KraftDATE ENCOUNTERED 12-3-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12-3-81DATE BORING COMPLETED 12-3-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25		Medium to coarse sand w/ some pea gravel	18/18	S-6	D
					25.5	
					29.0	
	30			18/18	S-7	D
					30.5	
					34.0	
	35			12/18	S-8	D
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-24

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING N. G-25DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25			No Sample	S-6	D
					25.5	
					29.0	
	30			9/18	S-7	D
					30.5	
					34.0	
	35			9/18	S-8	D
			T.O. 35.5		35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G-25

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAP

BORING NO. G-26

DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH 25.0

DRILLER'S NAME Kraft

DATE ENCOUNTERED 12-5-81

GEOLOGIST NAME Sneed

GROUND ELEVATION

RIG MAKE/ MODEL CME-55

GEOLOGIST'S SIGNATURE

DATE BORING STARTED 12-5-81

DATE BORING COMPLETED 12-5-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Brown clayey top soil w/ organics Sharp	12/12	S-1	0 sample S-1 Taken from auger
		CL	Grayish brown stiff low plasticity moist, sandy, silty clay No free water 5/2-2.5Y Fluvial		1.0	Measurement Depth - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
	5				4.0	
				18/18	S-2	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40# hammer)
					5.5	Hole Drilled w/11" O.D & 6" I.D. U.S.A.
						No water used.
					9.0	P.V.C. dropped about 1 ft. when augers were pulled.
	10				8.3	
					0.5	Hole caved at 21.0 ft.
			Sharp			
		SP	Light yellowish brown loose fine to medium moist sand. W-1-2% pea gravel 6/4-2.5Y No free water Fluvial		14.0	
	15			12/18	S-4	
					15.5	
					9.0	
	20			12/18	S-5	

20.5

PROJECT CAAP

BORING G- 26

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING NO. G-26DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 25.0DRILLER'S NAME Kraft

DATE ENCOUNTERED _____

GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED _____

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25		Free water observed on bit at 25.0	No Sample	S-6	P
					25.5	
					29.0	
	30		Becoming light gray and medium to coarse between 26 and 29 ft.	18/18	S-7	D
					30.5	
					34.0	
	35			18/18	S-8	D
					35.5	
					39.0	
	40		TD 40.5		S-9	D

40.5

PROJECT CAAPBORING G-26

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G-27DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 13.5DRILLER'S NAME KraftDATE ENCOUNTERED 12-6-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/ MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12-6-81DATE BORING COMPLETED 12-6-81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Dark brown clayey top soil with organic Sharp	12/12	S-1	0 sample S-1 Taken from auger
		CL	Grayish brown stiff silty clay with iron stains, moist, no free water S/2-2.5Y Fluvial 25-30% silt		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
					4.0	
	5			18/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40# hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
					5.5	No water used.
					9.0	Center plug of augers not used from 25 to 40
	10			18/18	S-3	P PVC dropped about 1 ft. when augers were pulled
					0.5	Hole caved at 23.0 ft.
					14.0	
	15		Sharp	18/18	S-4	P
		SP	Light yellowish brown, loose moist fine sand 6/4-2.5Y No free water Fluvial with a few thin (1"-4") light gray silt seams		5.5	
					9.0	
	20			9/18	S-5	P

20.5

PROJECT CAAPBORING G-27

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING NO. G-27DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 23/5DRILLER'S NAME KraftDATE ENCOUNTERED 12-6-81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12-6-81DATE BORING COMPLETED 12-6-81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVER ERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25		Becoming m-dium to coarse and light gray N6/-2.5Y	12/18	S-6	D
					25.5	
					29.0	
	30			18/18	S-7	D
					30.5	
					34.0	
	35			18/18	S-8	D
					35.5	
					39.0	
	40		td 40.5	18/18		D

40.5

PROJECT CAAPBORING G-27

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAMPBORING NO. G- 28DRILLING CONTRACTOR SWI.FIRST ENCOUNTERED WATER DEPTH 21.8DRILLER'S NAME KraftDATE ENCOUNTERED 12/7/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/7/81DATE BORING COMPLETED 12/7/81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Dark brown to black top soil w/organics sharp	12/12	S-1	0 sample S-1 Taken from auger
		CL	Grayish brown Stiff moist silt clay 25-30% silt		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
			5/2 - 2.5 y Fluvial		4.0	
	5			18/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A.
			Sharp		5.5	No water used
			Light yellow brown loose fine sand Moist (no face water)	12/12	9.0	Center plug of auger not used from 25-40
	10	SP	6/4 - 2.5Y Fluvial w/1-2% pea gravel		5.3	P
					0.5	PVC dropped about 1 foot when augers were pulled
					14.0	
	15			14/18	S-4	P
					5.5	
					9.0	
	20			18/18	S-5	P

20.5

PROJECT CAMPBORING G- 28

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING N. G-28DRILLING CONTRACTOR SWI.

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME KraftDATE ENCOUNTERED 12/7/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CMF-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/7/81DATE BORING COMPLETED 12/7/81

LEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVER ERY	BOX OR SAMPLE NO.	REMARKS
			Becoming medium to coarse between 25 & 30 ft.		24.0	
	25			9/18	S-6	D
					25.5	
					29.0	
	30			9/18	S-7	D
			Becoming gray between 30 and 35 ft.		30.5	
					34.0	
	35			18/18	S-8	D
					35.5	
					39.0	
	40		TD 40.5'	18/18		D

40.5

PROJECT CAAPBORING G- 28

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. 29DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 18.0DRILLER'S NAME KraftDATE ENCOUNTERED 11/5/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED 11/5/81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVER ERY	BOX OR SAMPLE NO	REMARKS
			Grayish tan clayey top soil w/organics	12/12	S-1	0 sample S-1 Taken from auger
		CL	Silty stiff dark grayish brown low plastic clay, dry to damp no free water 4-2 - 10 yr Fluvial origin		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
					4.0	
			Sharp	3/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer Hole drilled w/1" O.D. S 6" I.D. H.S.A.
		SW	Light gray fine loose sand w/1 to 2% pea gravel, moist No free water 7-2 - 2.5 y Fluvial origin		5.5	
					9.0	
	10		Coarsening downward to a medium size	12/18	S-3	P
					10.5	
					11.0	
	15			12/18	S-4	P
					15.5	
			Free water encountered at 18.0 ft.			
			Free water observed in sample S-5			
					19.0	
	20			12/18	S-5	P

20.5

PROJECT CAAPBORING 29

BORING LOG

PAGE 2 OF 2 PAGE

PROJECT CAAPBORING NO. G-29DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 18.0DRILLER'S NAME KraftDATE ENCOUNTERED 11/5/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED _____

DATE BORING COMPLETED 11/5/81

LEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25			NO SAMPLE	S-6	P & D
					25.5	
					29.0	
	30			18/18	S-7	D
					30.5	
					34.0	
	35		TD 35.5	NO SAMPLE	S-8	D
					35.5	
					39.0	
	40					
					40.5	

PROJECT CAAPBORING G-29

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G- 30DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 18DRILLER'S NAME KraftDATE ENCOUNTERED 12/4/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/4/81DATE BORING COMPLETED 12/4/81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Top soil is black to dark brown clay w/some organic	12/12	S-1	0 sample S-1 Taken from auger
					1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
			Light yellowish brown fine loose moist sand. The top 6" of the sample is a gray clay w/silt			
			No free water		4.0	
	5			18/18	S-2 P	All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. U.S.A.
			Sand encountered at 7' depth		5.5	No water used
					9.0	Hole caved to 14.5
	10			12/18	S-3 P	
					10.5	
					14.0	
	15		Becoming fine to medium at 15 ft. depth	12/18	S-4 P	
					15.5	
			Free water observed on the bit at 18 ft.		19.0	
	20			10/18	S-5 P	

20.5

PROJECT CAAPBORING G- 30

BORING LOG

PAGE 2 OF 2 PAGEPROJECT CAAPBORING N. G-30DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 18'DRILLER'S NAME KraftDATE ENCOUNTERED 12/4/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/4/81DATE BORING COMPLETED 12/4/81

LEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOV ERY	BOX OR SAMPLE NO	REMARKS
			Becoming medium to coarse w/some pea gravel			
	25		No sample between 24- 25½ ft.	0/18	S-6	P
					24.0	
					25.5	
	30			18/18	S-7	D
					29.0	
					30.5	
					34.0	
	35		TD 35.5	18/18	S-8	D
					35.5	
					39.0	
	40					

40.5

PROJECT CAAPBORING G- 30

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. G- 31DRILLING CONTRACTOR SWL

FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME KraftDATE ENCOUNTERED 12/4/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/4/81DATE BORING COMPLETED 12/4/81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black clayey top soil w/organics Sharp Moist	12/12	S-1	0 sample S-1 Taken from auger
		CL	Light yellowish brown stiff moist silty clay 6/4 - 2.5 yr No free water Fluvial Sharp		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
		SP	Light yellowish loose brown fine sand w/1-2% pea gravel Moist No free water 6/4 - 2.5 yr Fluvial		4.0	All samples in Plastic bags
	5			6/18	S-2	P Method of taking samples Pushed - P Driven w/ - D (40#hammer)
					5.5	Bole Drilled w/11" O.D. L 6" I.D. H.S.A.
					9.0	No water used
	10			12/18	S-3	P
					10.5	
					14.0	
	15			12/18	S-4	P
					15.5	
					19.0	
	20			12/18	S-5	D

20.5

PROJECT CAAPBORING G- 31

BORING LOG PAGE 2 OF 2 PAGE

PROJECT CAAP BORING NO. G-31

DRILLING CONTRACTOR SWL FIRST ENCOUNTERED WATER DEPTH _____

DRILLER'S NAME Kraft DATE ENCOUNTERED 12/4/81

GEOLOGIST NAME Sneed GROUND ELEVATION _____

RIG MAKE/ MODEL CME-55 GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/4/81 DATE BORING COMPLETED 12/4/81

LEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOV ERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25		Becoming medium to coarse between 21 & 23 ft.	18/18	S-6	D
					25.5	
					29.0	
	30			18/18	S-7	D
					30.5	
					34.0	
	35		TD 35.5	18/18	S-8	D
					35.5	
					39.0	
	40					
					40.5	

PROJECT CAAP

BORING G- 31

BORING LOG

PAGE 1 OF 3 PAGE

PROJECT CAAPBORING NO. C- 32DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 25'DRILLER'S NAME KraftDATE ENCOUNTERED 12/7/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/7/81DATE BORING COMPLETED 12/7/81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Black clayey top soil w/organics Sharp	12/12	S-1	0 sample S-1 Taken from auger
			Grayish brown stiff moist silty clay w/ 25-30% silt 5/2 - 2.5 y Fluvial		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
		CL			4.0	
	5			18/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled 8/11" O.D. E 6" I.D. H.S.A.
					5.5	No water used Center plug of auger not used
					6.0	
	10		Sharp	18/18	S-3	P PVC dropped about 1 ft. when augers were pulled
			Light yellowish brown loose moist fine sand w/ 1-2% pea gravel Fluvial		6.5	Hole caved at 29.0'
		SW			14.0	
	15			12/18	S-4	P
					15.5	
					19.0	
	20			12/18	S-5	D

20.5

PROJECT CAAPBORING C- 32

BORING LOG

PAGE 2 OF 3 PAGEPROJECT CAAPBORING N. G-32DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 25'DRILLER'S NAME KraftDATE ENCOUNTERED 12/7/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/ MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/7/81DATE BORING COMPLETED 12/7/81

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
					24.0	
	25			18/18	S-6	D
					25.5	
					29.0	
	30		Becoming fine to medium at 30 feet	18/18	S-7	D
					30.5	
					34.0	
	35		Becoming gray and medium to coarse at 35 feet	12/18	S-8	D
					35.5	
					39.0	
	40			18/18	S-9	D

40.5

PROJECT CAAPBORING G-32

BORING LOG

PAGE 3 OF 3 PAGE

PROJECT CAAPBORING NO. G-32DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 25'DRILLER'S NAME KraftDATE ENCOUNTERED 12/7/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE / MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/7/81DATE BORING COMPLETED 12/7/81

LEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOV ERY	BOX OR SAMPLE NO	REMARKS
	45		TD 45.5	18/18	S-10	D

PROJECT CAAPBORING G-32

BORING LOG

PAGE 1 OF 2 PAGE

PROJECT CAAPBORING NO. 6- 33DRILLING CONTRACTOR SWLFIRST ENCOUNTERED WATER DEPTH 20'DRILLER'S NAME KraftDATE ENCOUNTERED 12/6/81GEOLOGIST NAME Sneed

GROUND ELEVATION _____

RIG MAKE/MODEL CME-55

GEOLOGIST'S SIGNATURE _____

DATE BORING STARTED 12/6/81DATE BORING COMPLETED 12/6/81

ELEV	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO	REMARKS
			Dark brown to black clayey top soil w/ organics Sharp	12/12	S-1	0 sample S-1 Taken from auger
		CL	Grayish brown stiff moist silty clay 5/2 - 2.5 y Fluvial		1.0	Measurement Depths - Ft. Samples - In. Recovery - In./In. All samples taken w/split spoon
			Sharp		4.0	
	5	SP	Light yellowish brown loose moist fine to medium sand w/1-5% pea gravel No free water Fluvial	12/18	S-2	P All samples in Plastic bags Method of taking samples Pushed - P Driven w/ - D (40#hammer) Hole Drilled w/11" O.D & 6" I.D. H.S.A. No water used
					5.5	
					9.0	Center plug of augers not used from 20 - 35
	10			18/18	S-3	P PVC dropped about 1 ft. when augers were pulled
					10.5	
					14.0	Hole caved at 19.5 ft.
	15			18/18	S-4	P
					15.5	
					19.0	
	20		Water observed on bit at 20 feet	18/18	S-5	D

20.5

PROJECT CAAPBORING 6- 33

PAGE 2 OF 2 PAGE

BORING N. G-33

FIRST ENCOUNTERED WATER DEPTH 20'

DATE ENCOUNTERED. 12/6/81

GROUND ELEVATION _____

GEOLOGIST'S SIGNATURE _____

DATE BORING COMPLETED 12/6/81

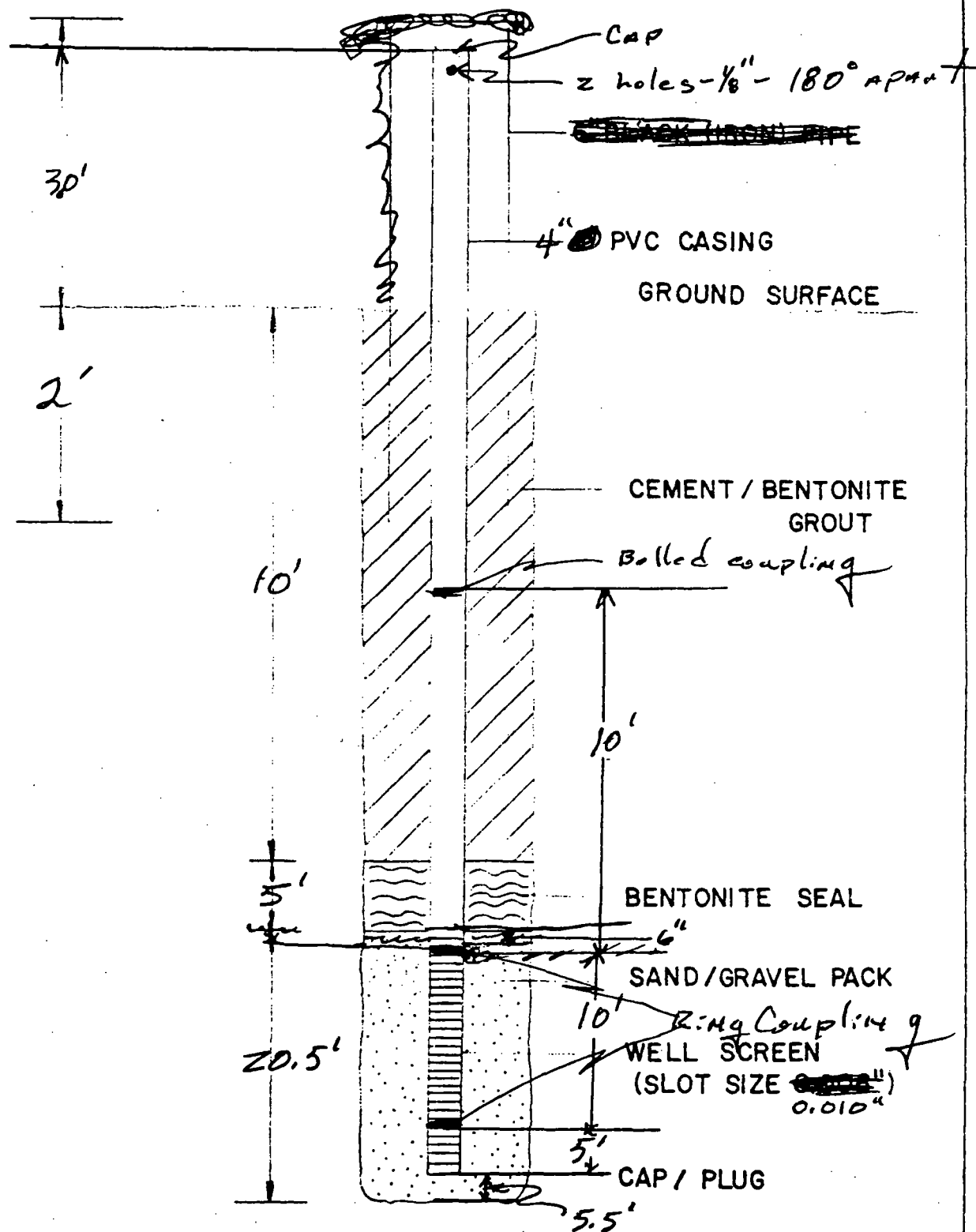
40.5

BORING 6- 33

APPENDIX B
MONITORING WELL SKETCHES

MONITOR WELL INSTALLATION

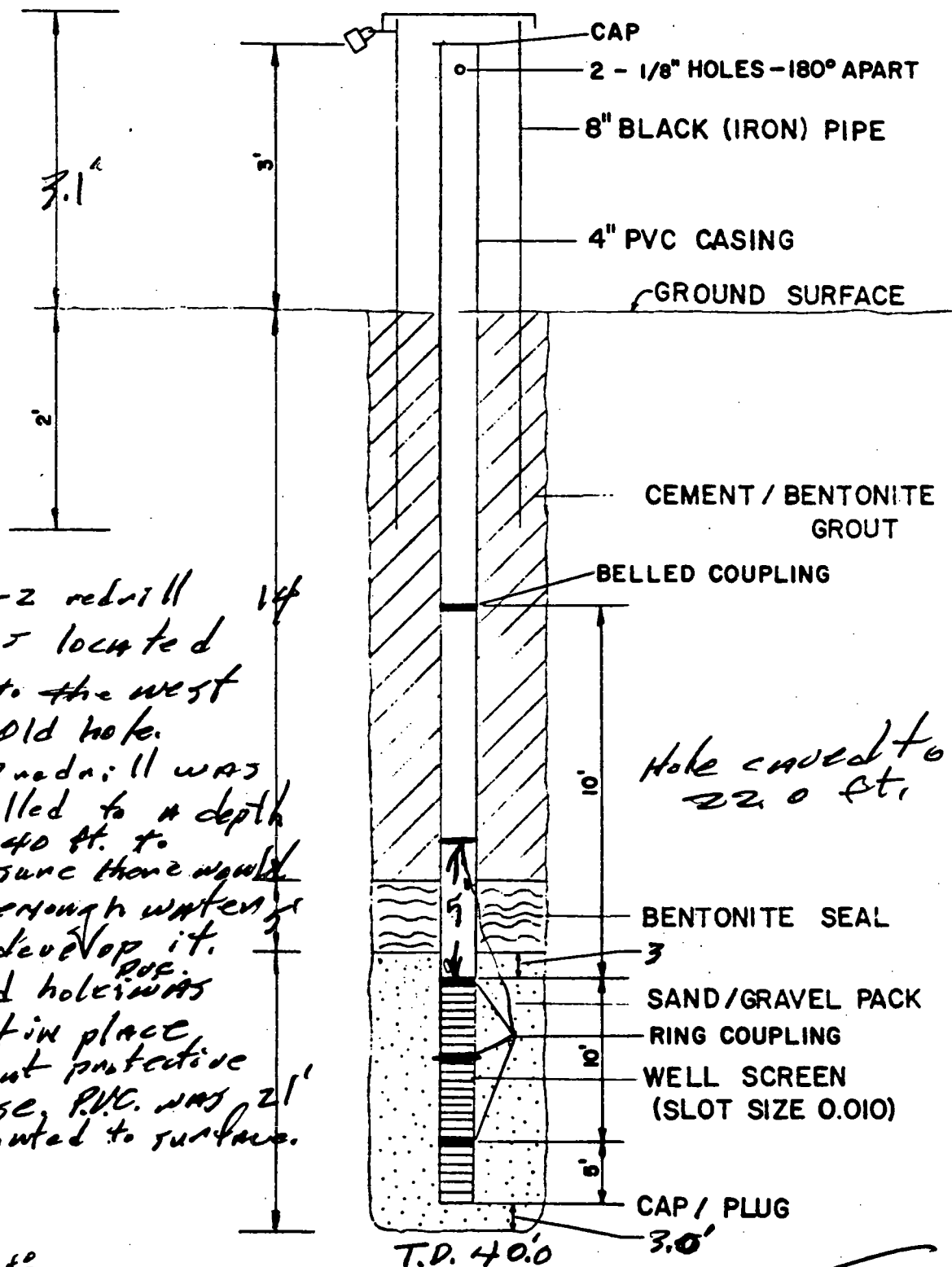
G-1



Overall length of 4" PVC - 33.5'

MONITOR WELL INSTALLATION

G-2
Redrill



G-2 redrill was located 5' to the west of old hole. G-2 redrill was drilled to a depth of 40 ft. to insure there would be enough water to develop it. Old hole was left in place w/out protective case, P.V.C. was grouted to surface.

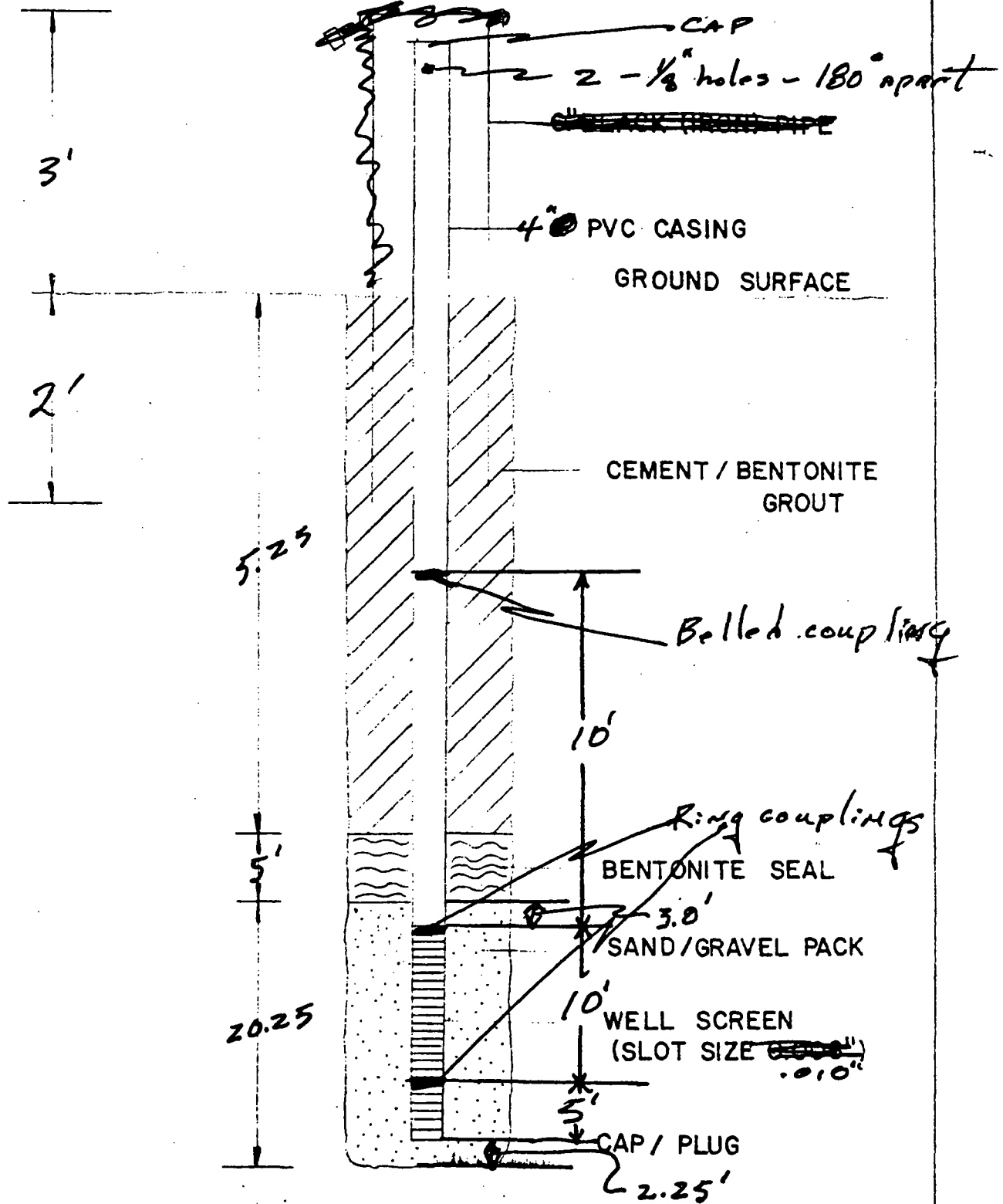
Hole caved to 22.0 ft.

OVERALL LENGTH OF 4" P.V.C. 39.5'

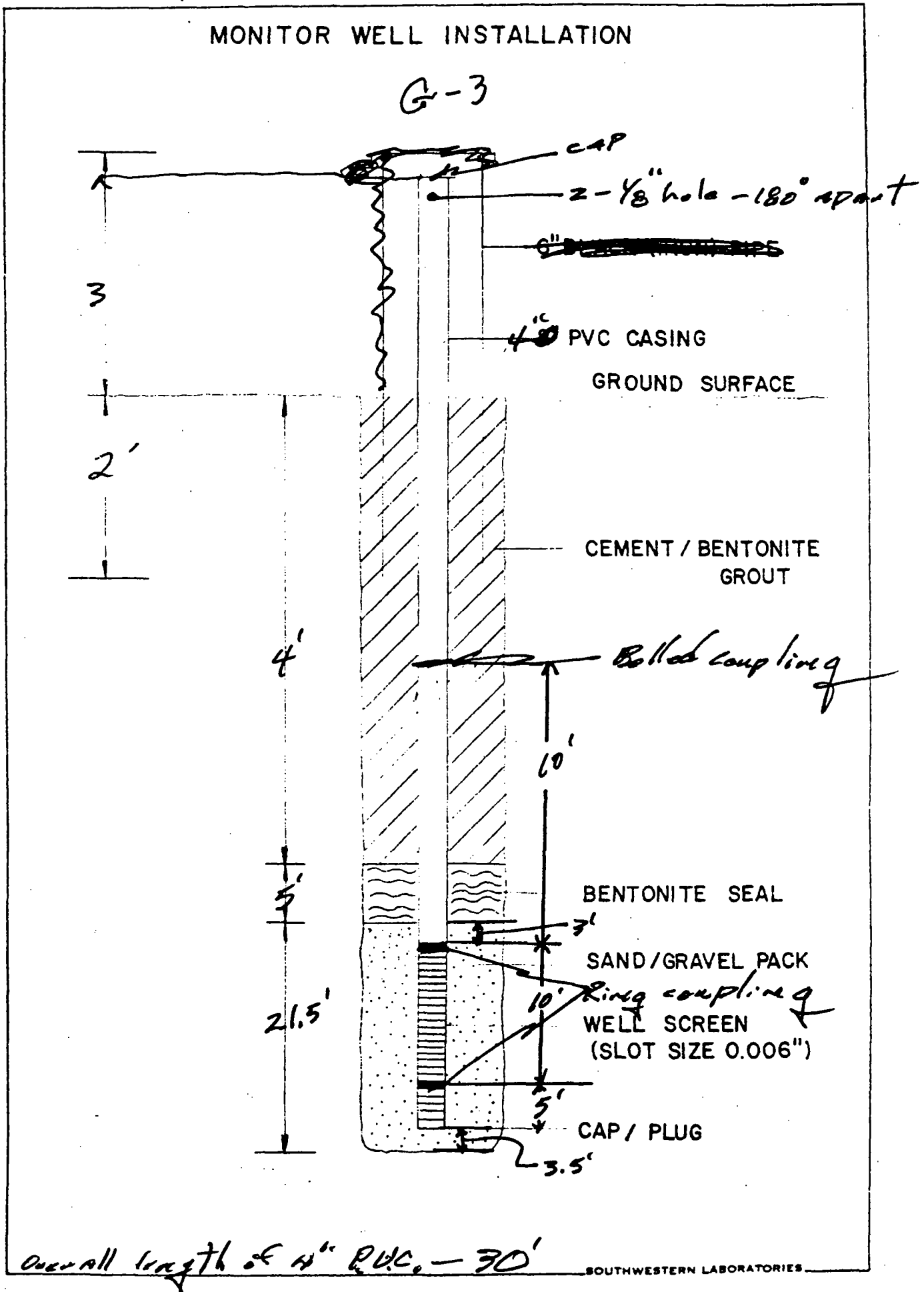
R. L. Bruce
SOUTHWESTERN LABORATORIES

MONITOR WELL INSTALLATION

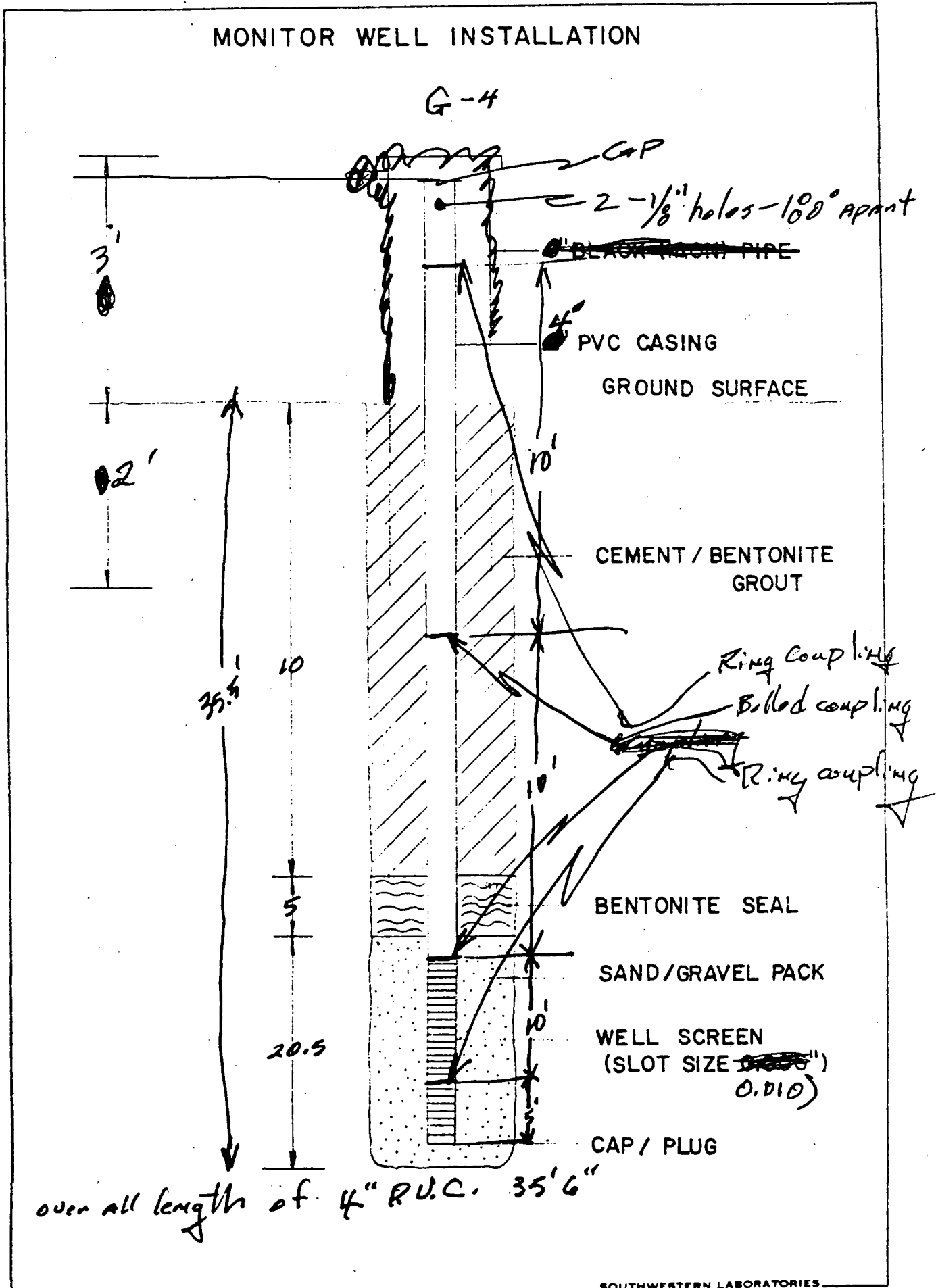
G-2



MONITOR WELL INSTALLATION

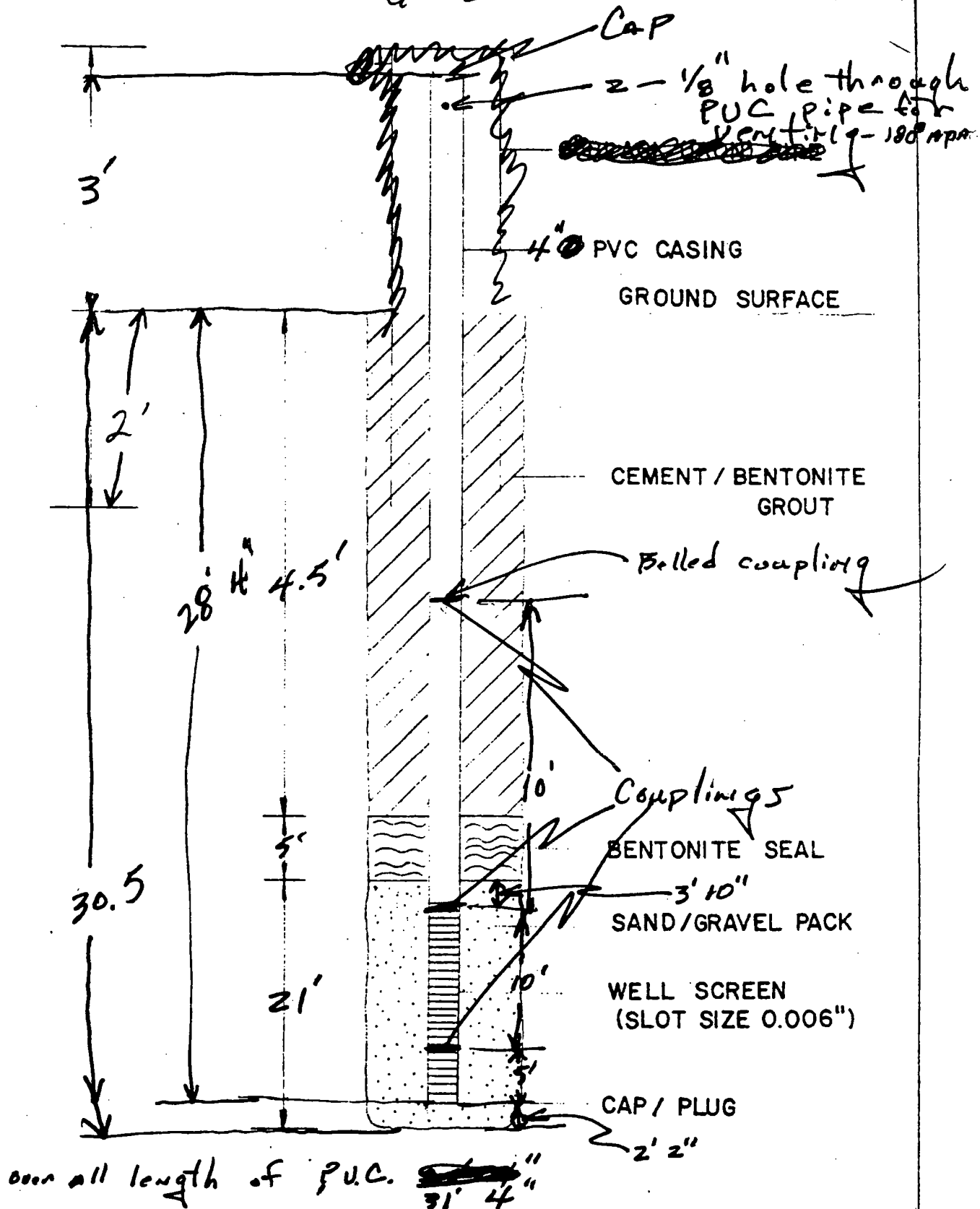


MONITOR WELL INSTALLATION

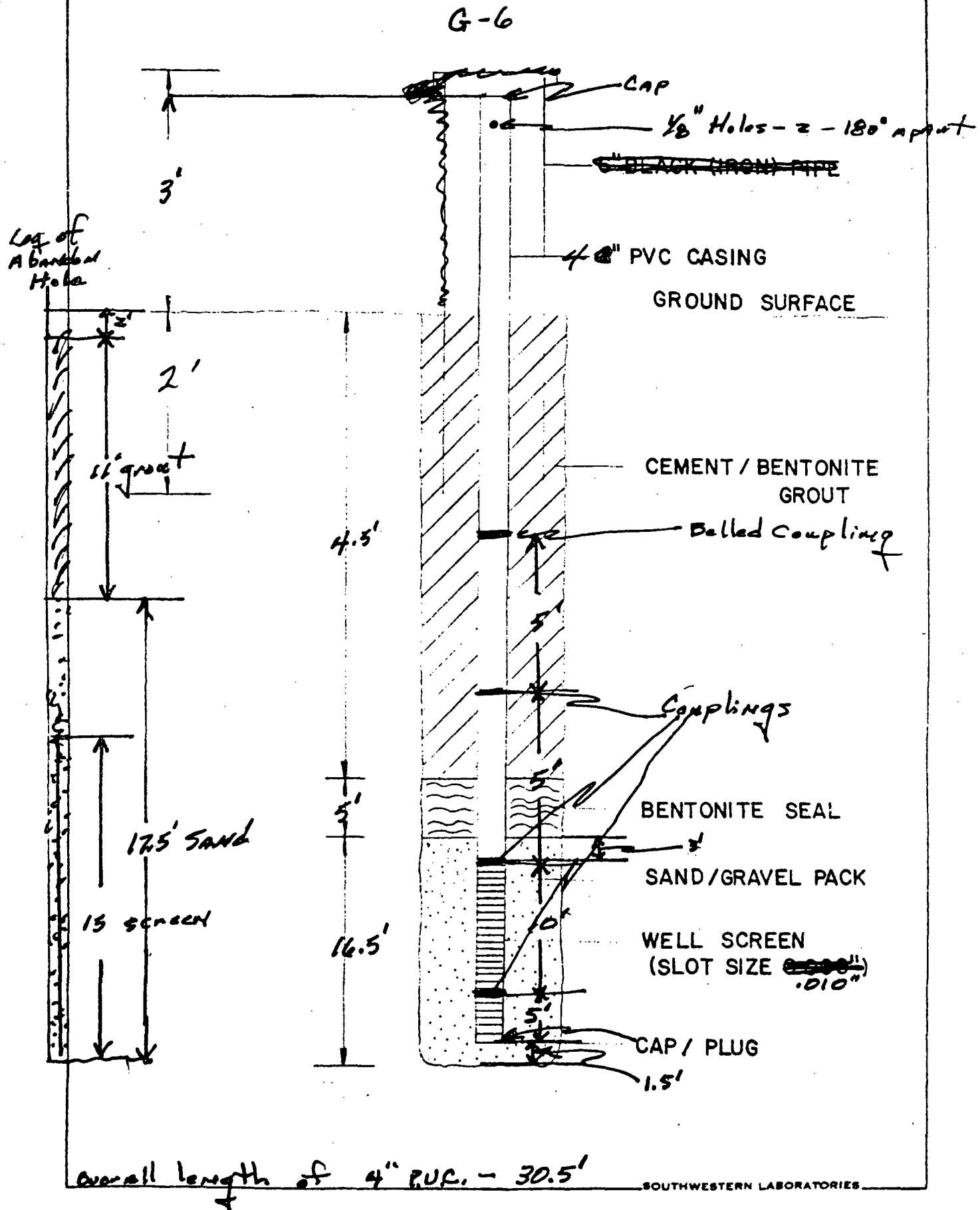


MONITOR WELL INSTALLATION

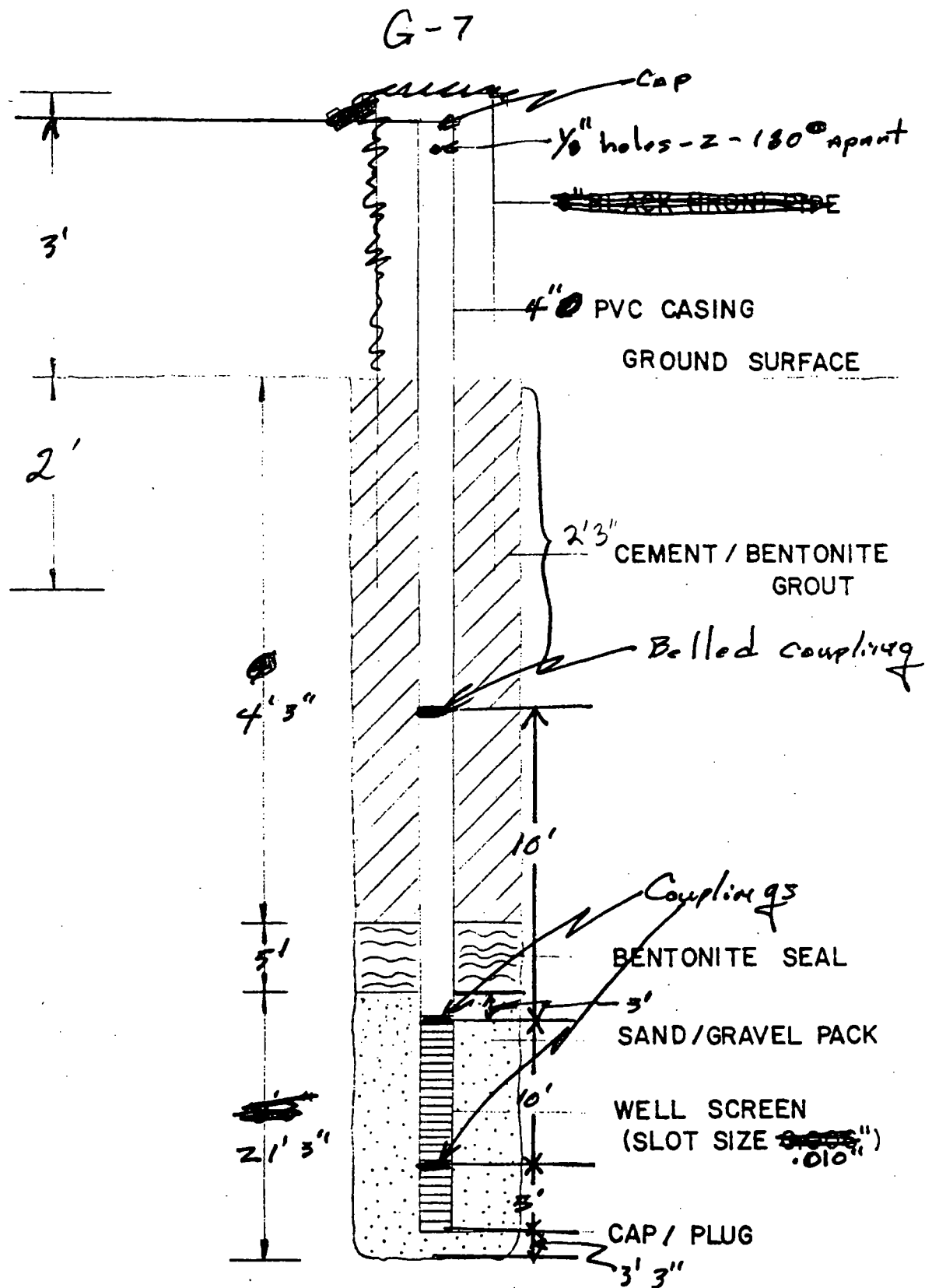
G-5



MONITOR WELL INSTALLATION

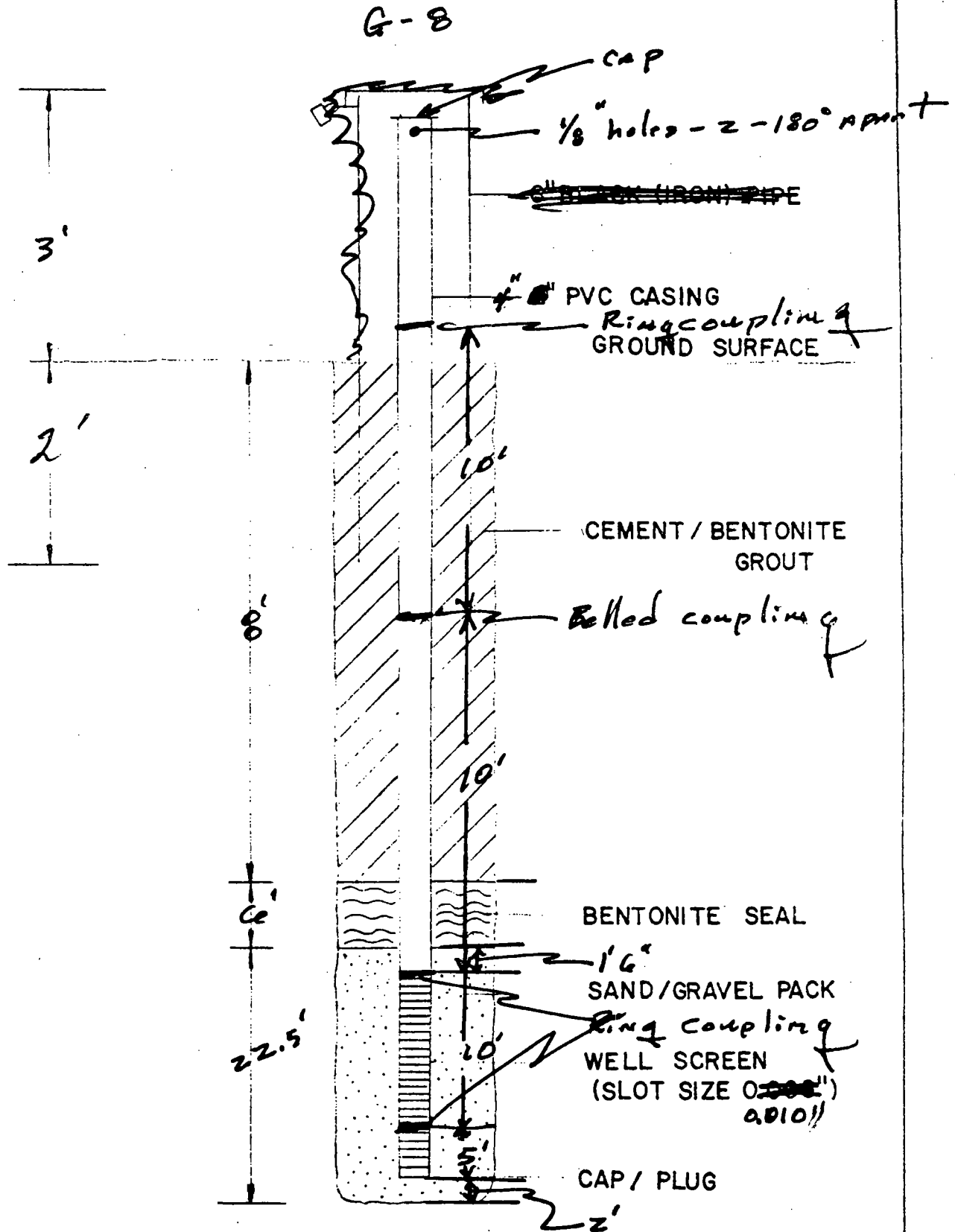


MONITOR WELL INSTALLATION



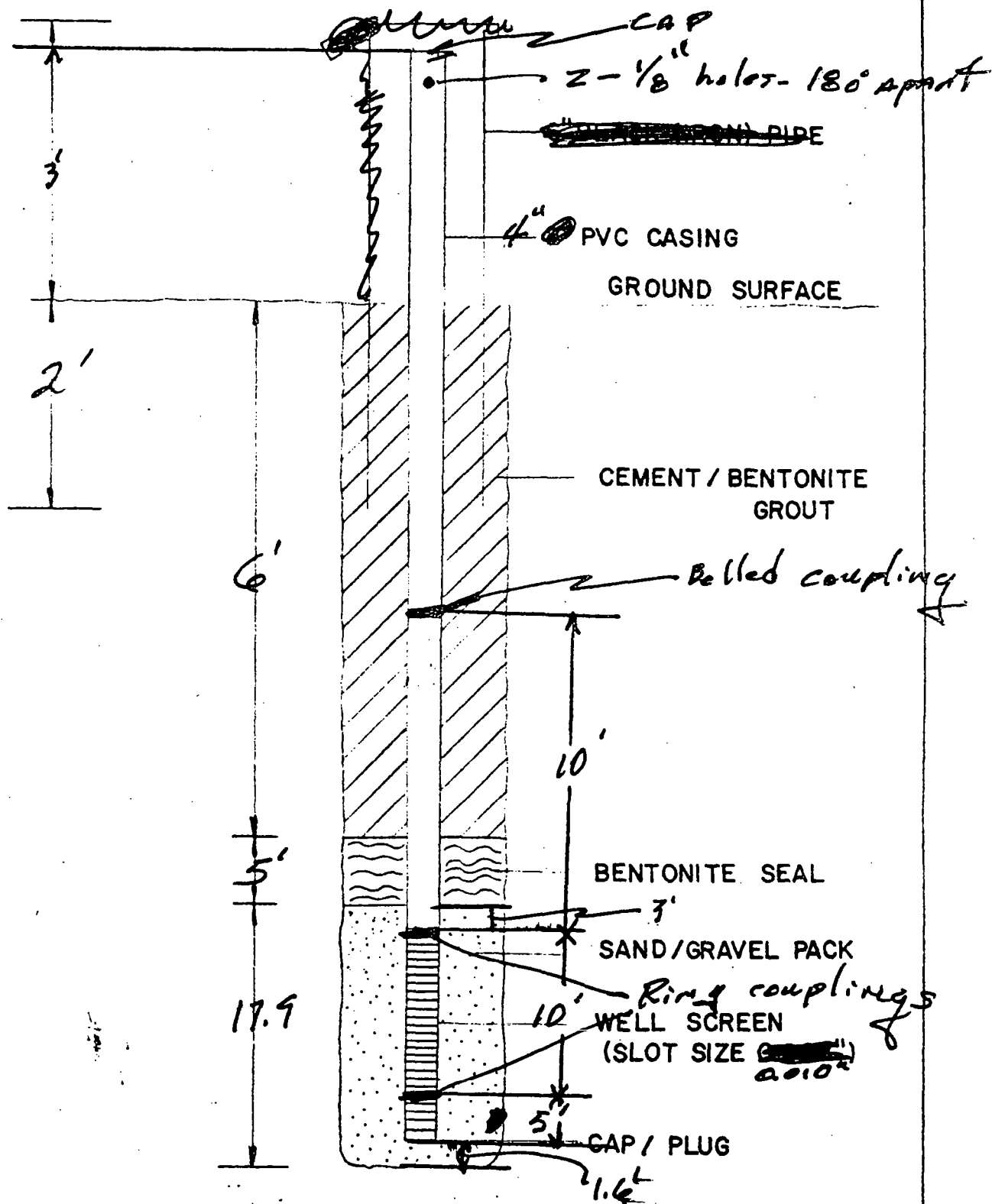
overall length of 4" P.V.C. 30' 3"

MONITOR WELL INSTALLATION



overall length of 4" P.V.C. - 36' 6"

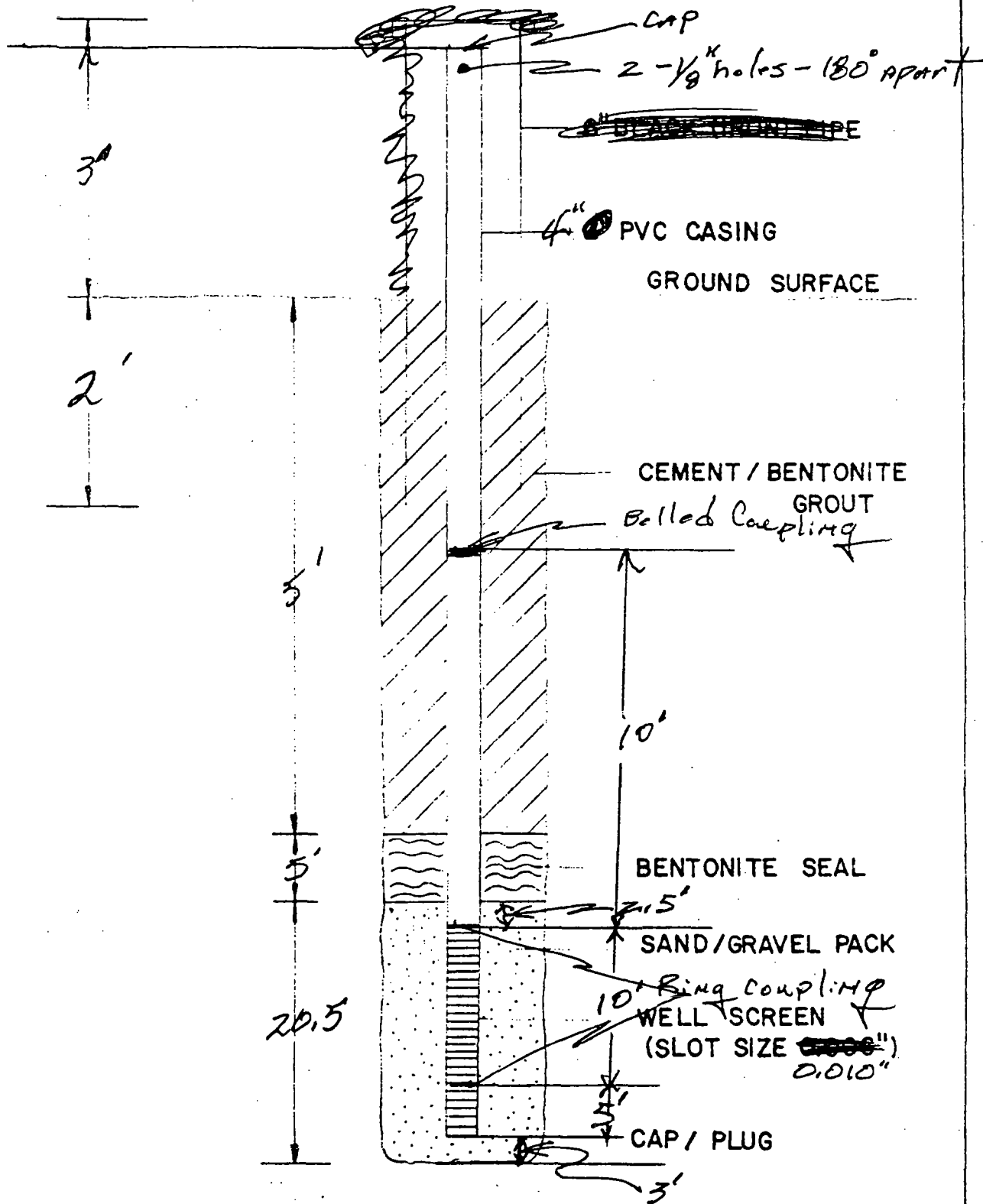
MONITOR WELL INSTALLATION



Overall length of 4" PVC - 31.9'

MONITOR WELL INSTALLATION

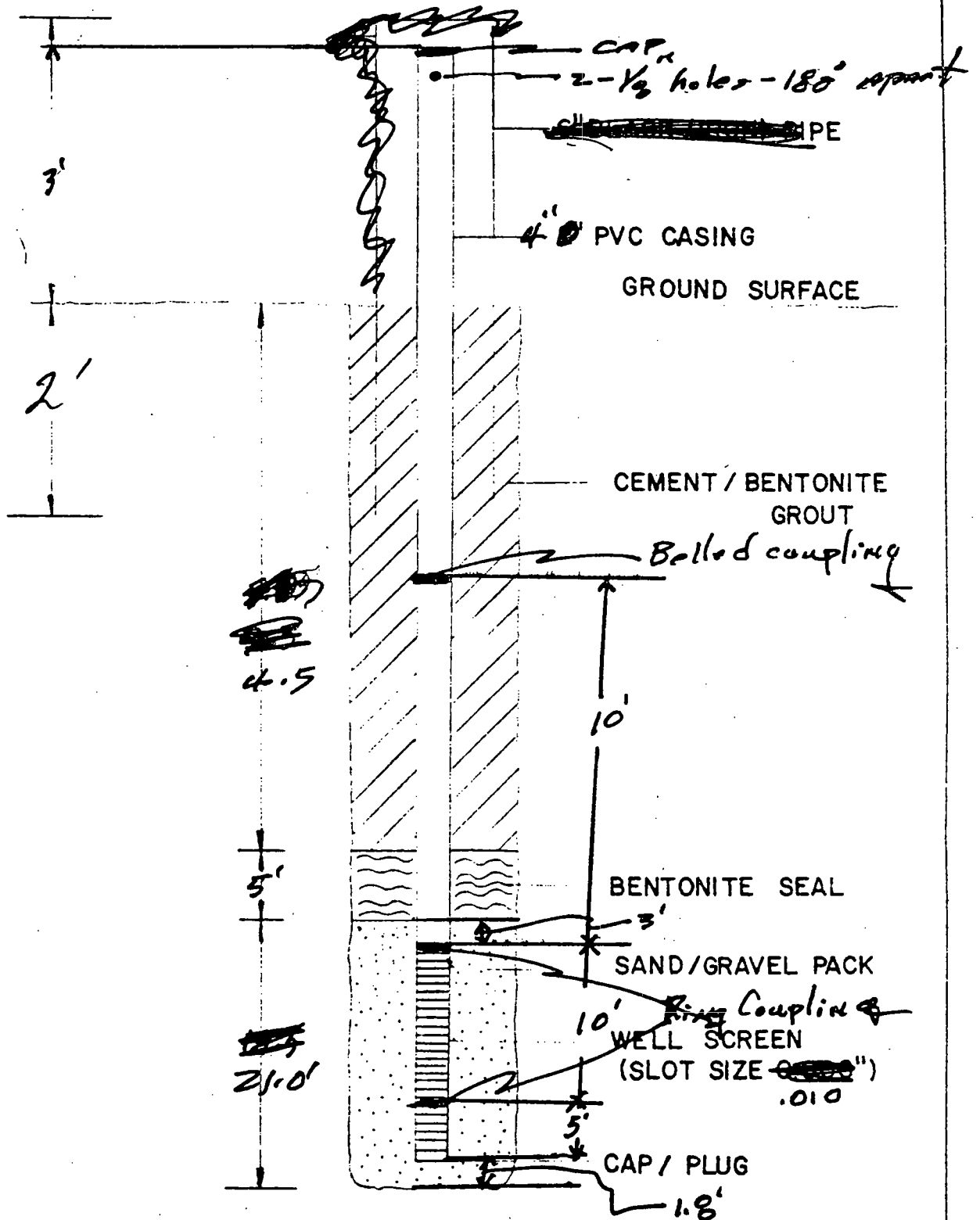
G-10



Overall length of 4" PVC. - 30.5'

MONITOR WELL INSTALLATION

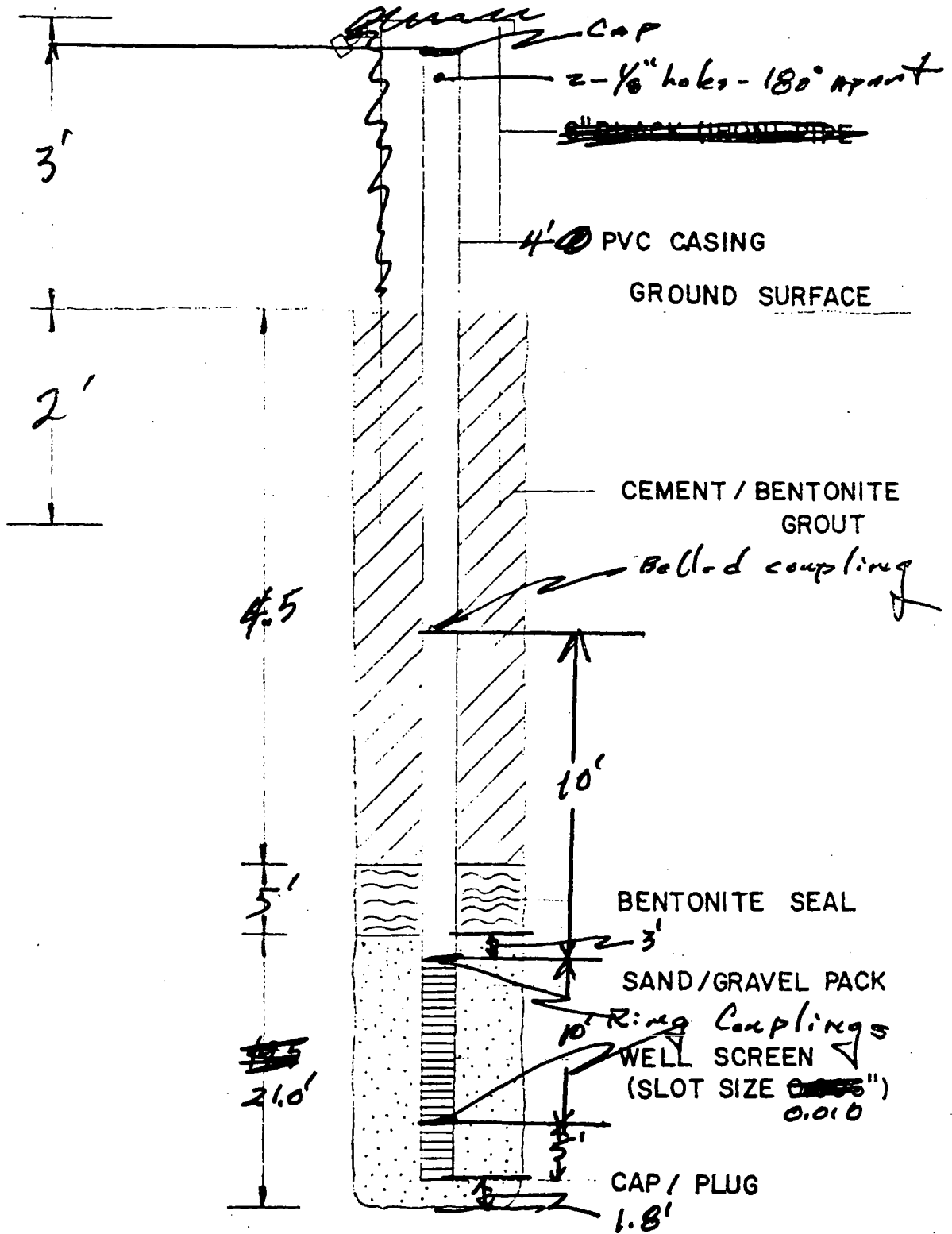
G-11



overall length of 4" PVC - 31.7'

MONITOR WELL INSTALLATION

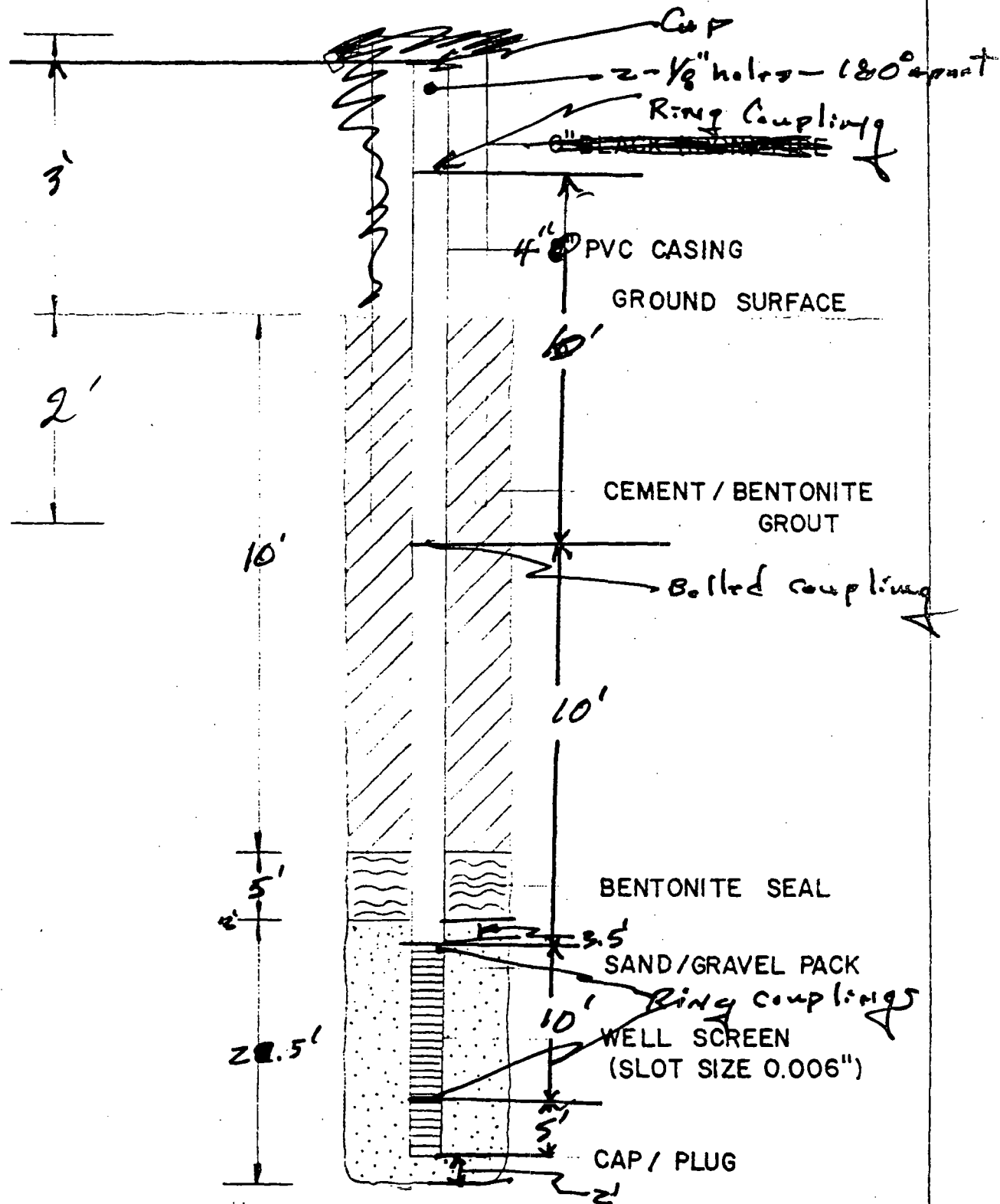
G-12



overall length of 4" P.V.C. - 30.7

SOUTHWESTERN LABORATORIES

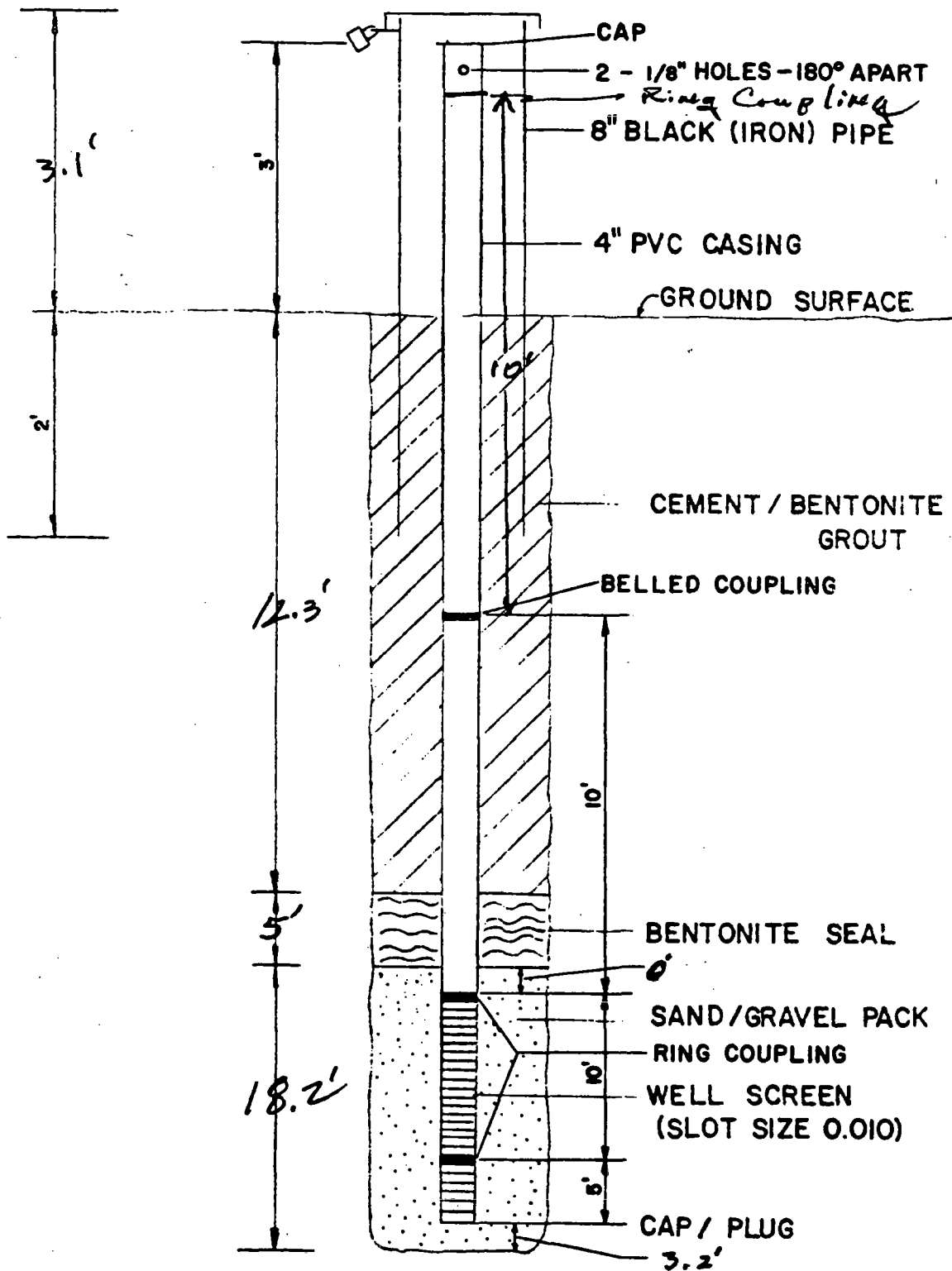
MONITOR WELL INSTALLATION



overall length of 4" PVC. - 36.5

MONITOR WELL INSTALLATION

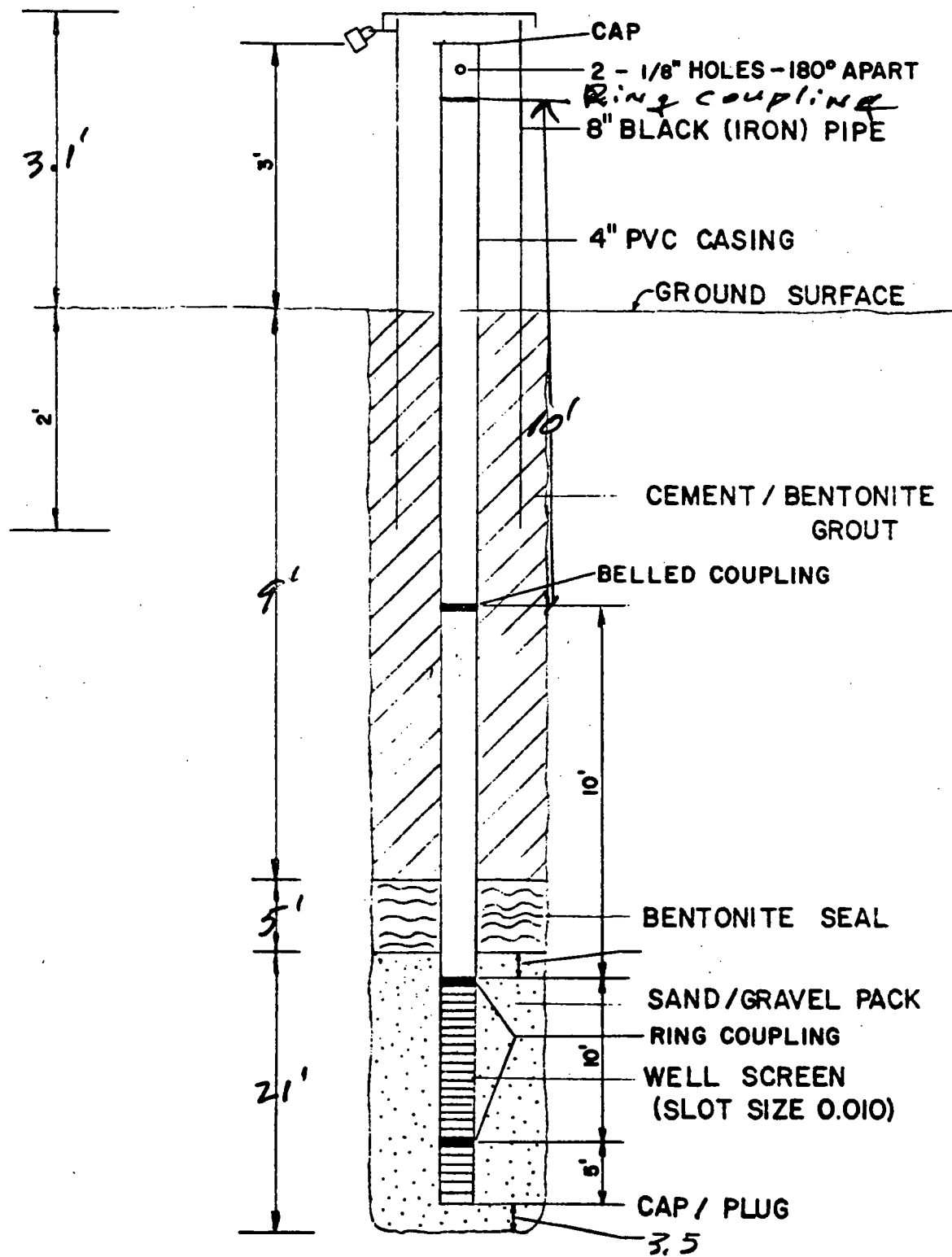
G-14



OVERALL LENGTH OF 4" P.V.C. - 35.3

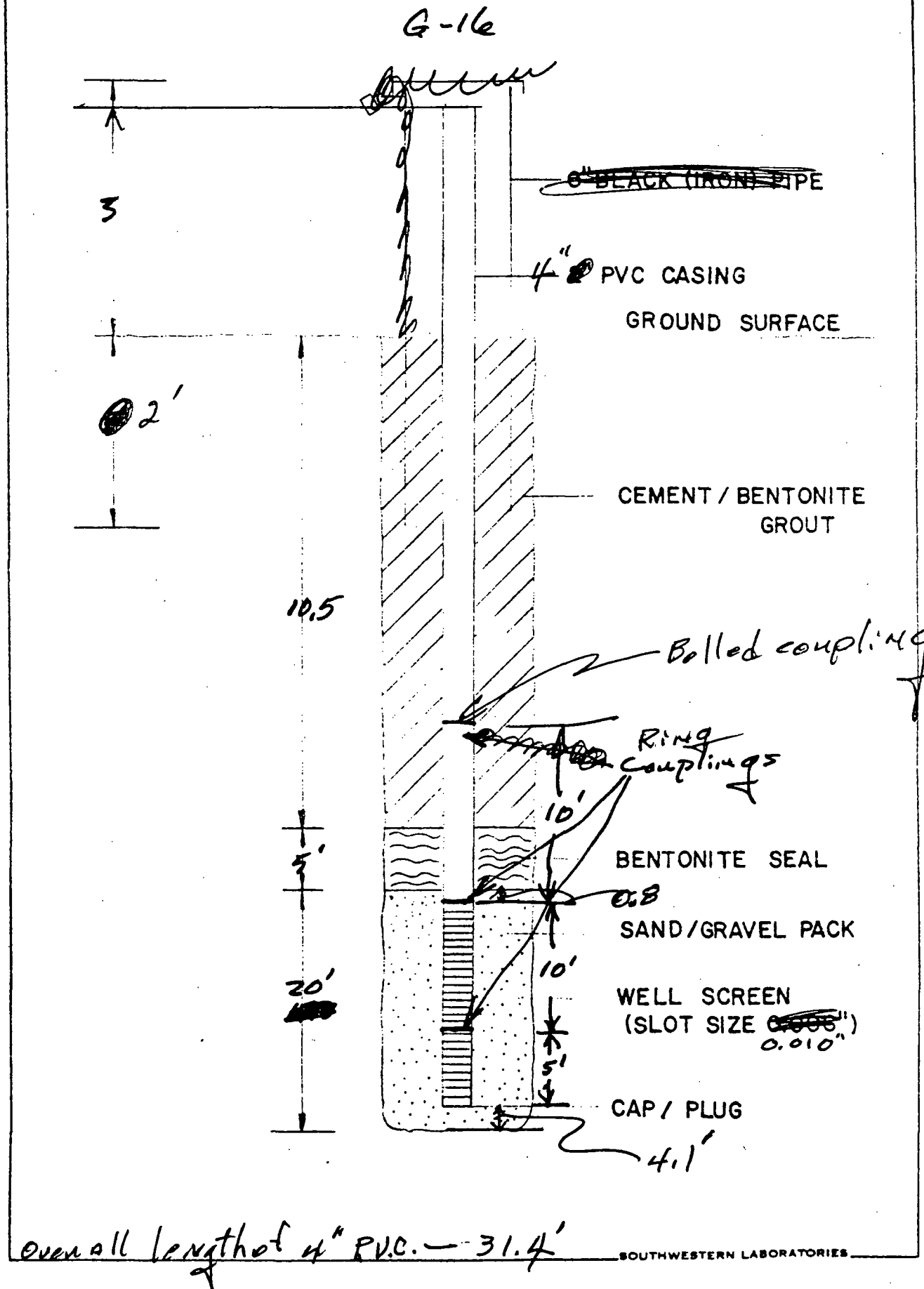
MONITOR WELL INSTALLATION

G-15



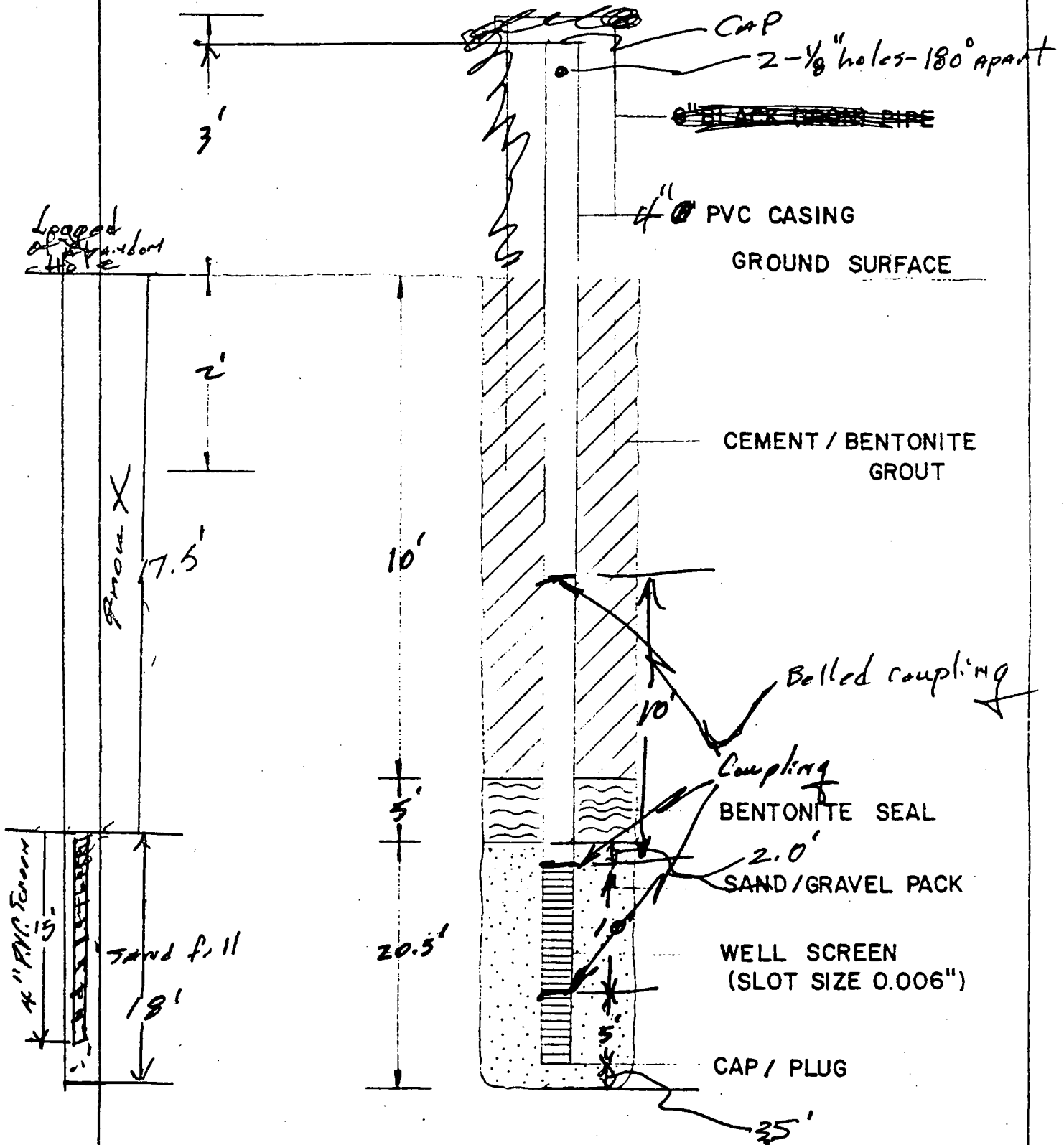
OVERALL LENGTH OF 4" P.V.C. = 35.0'

MONITOR WELL INSTALLATION



MONITOR WELL INSTALLATION

G-17

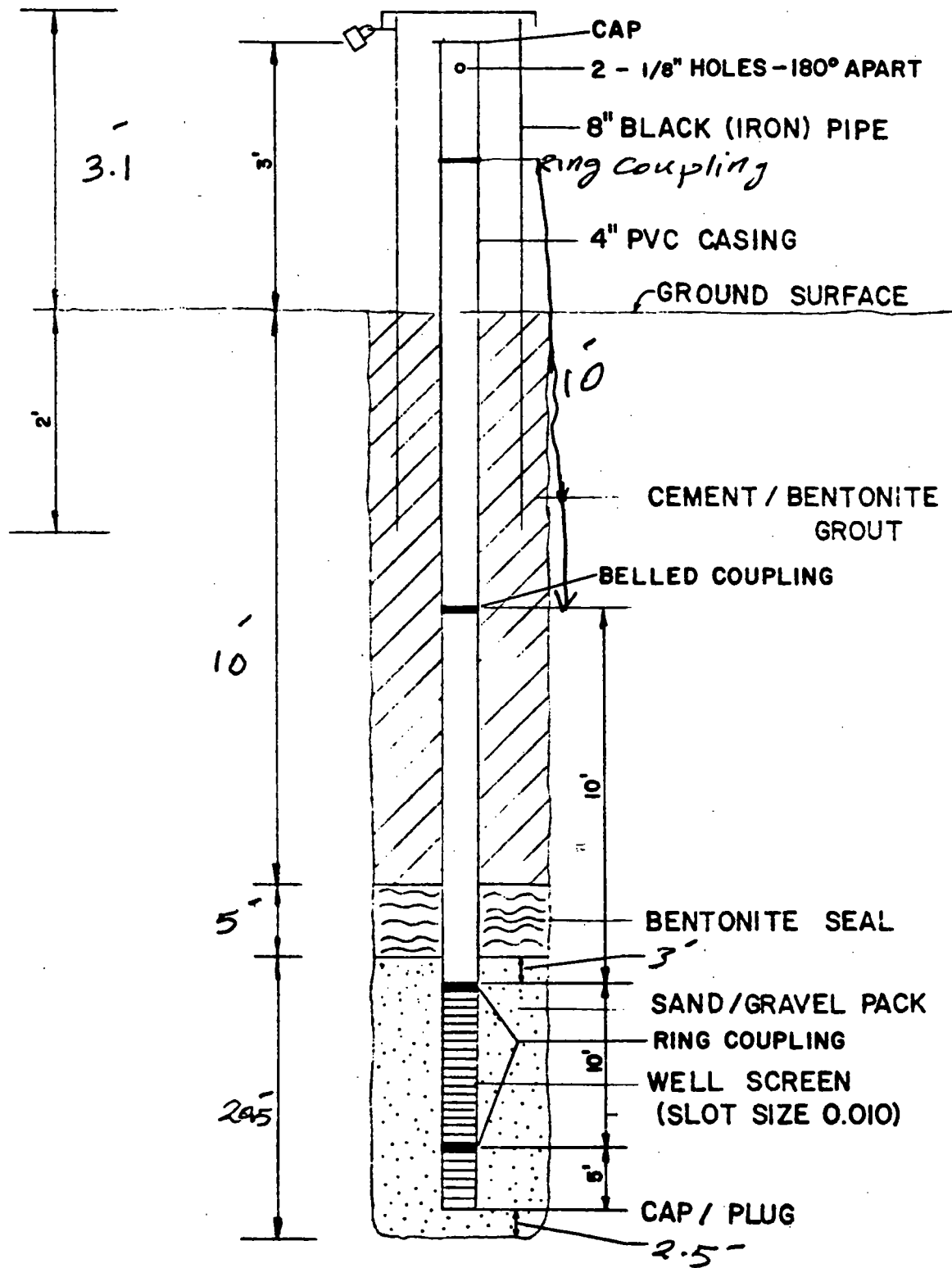


Overall length of 4" P.V.C. - 35.0'

SOUTHWESTERN LABORATORIES

MONITOR WELL INSTALLATION

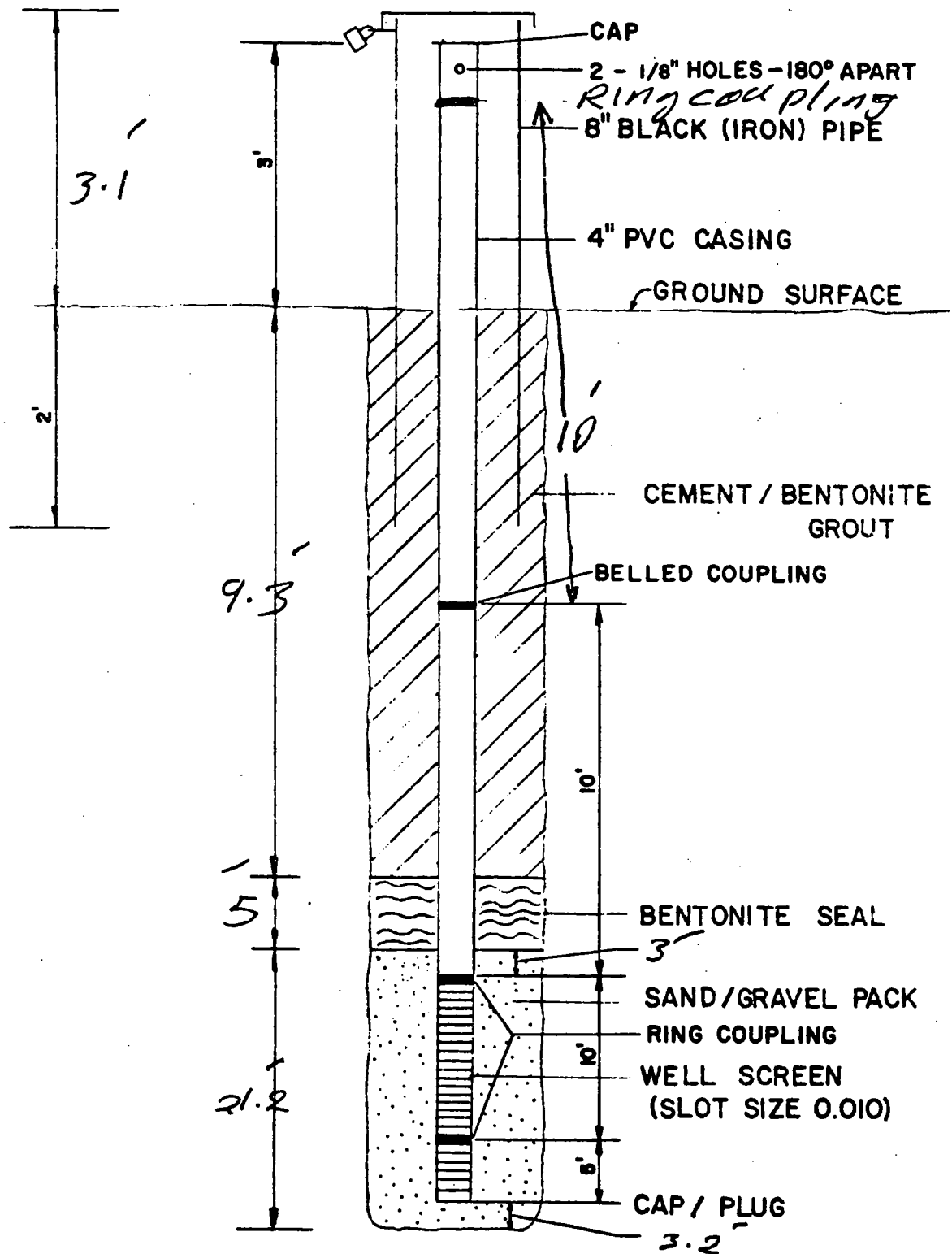
G18



OVERALL LENGTH OF 4" P.V.C. 36.0

MONITOR WELL INSTALLATION

G19

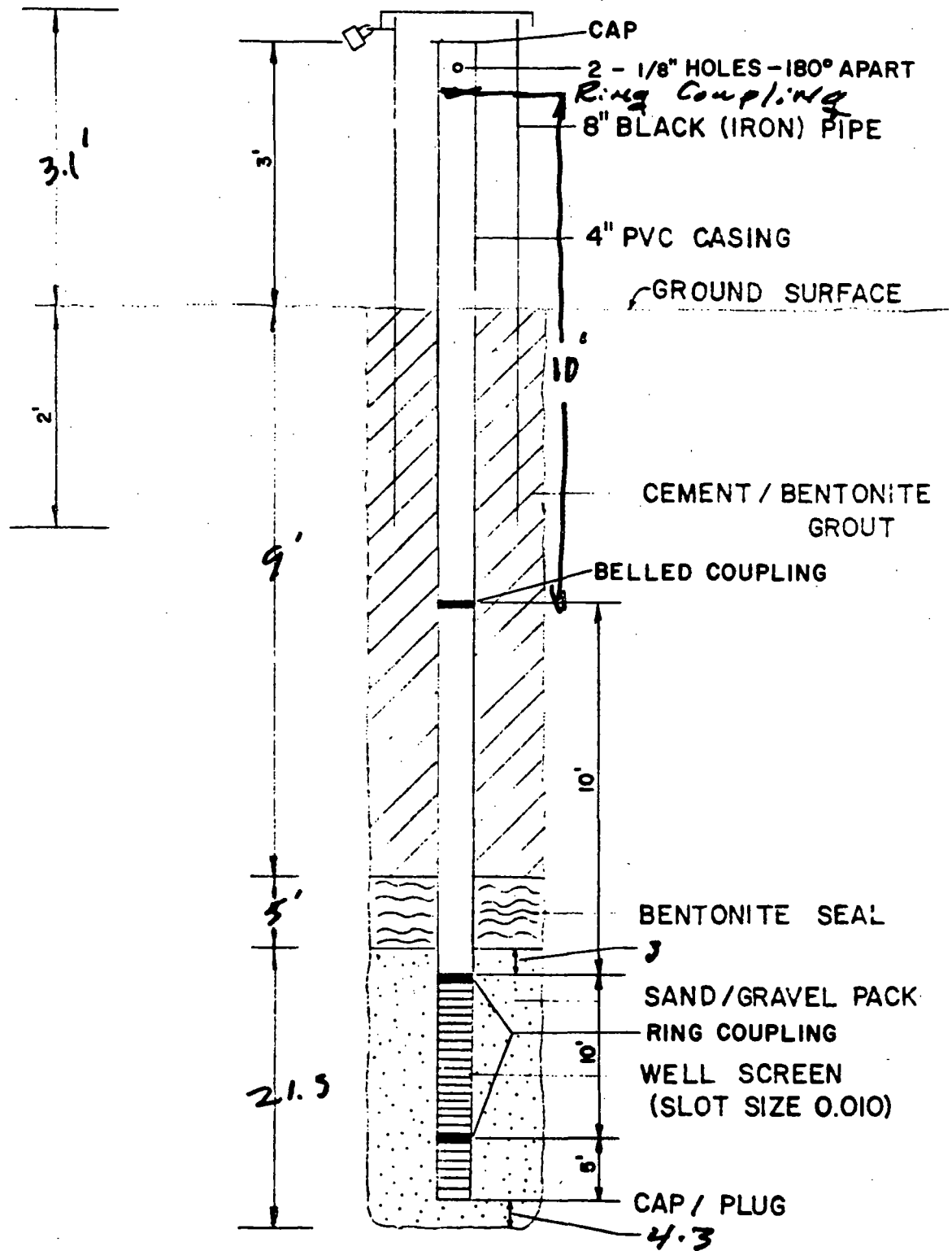


OVERALL LENGTH OF 4" P.V.C.

35.3'

MONITOR WELL INSTALLATION

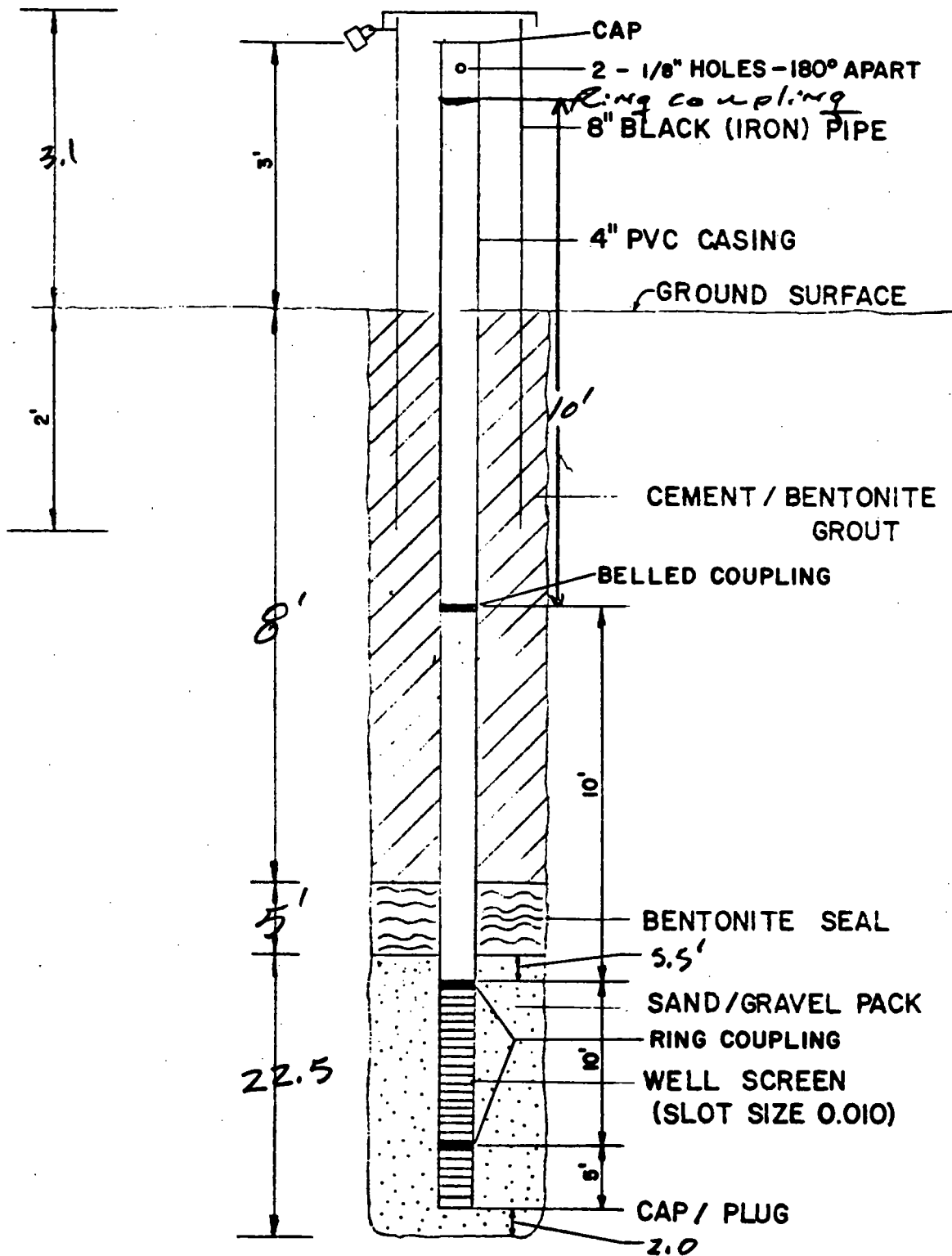
G-20



OVERALL LENGTH OF 4" P.V.C. 35.0

MONITOR WELL INSTALLATION

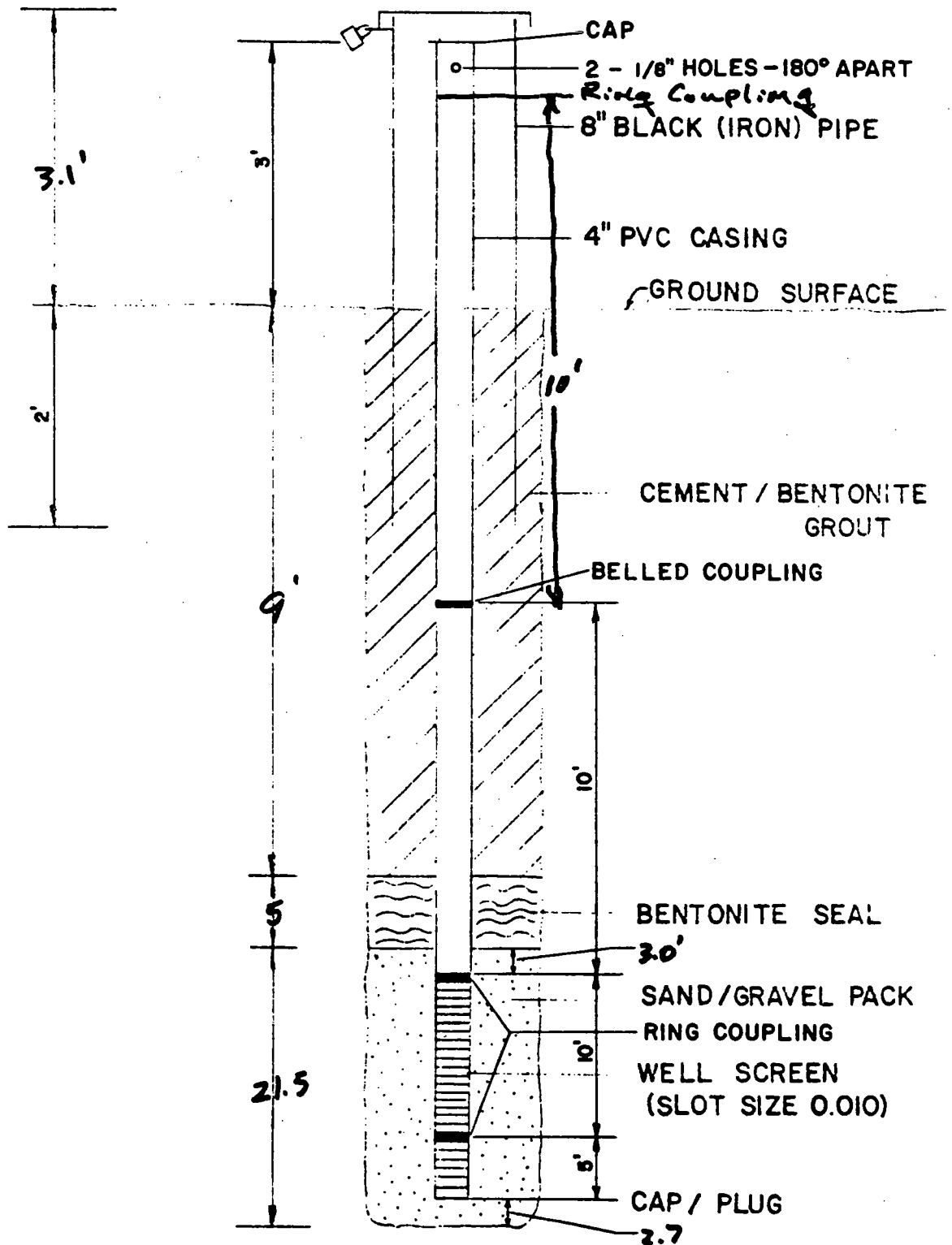
G-21



OVERALL LENGTH OF 4" P.V.C.

MONITOR WELL INSTALLATION

G-22



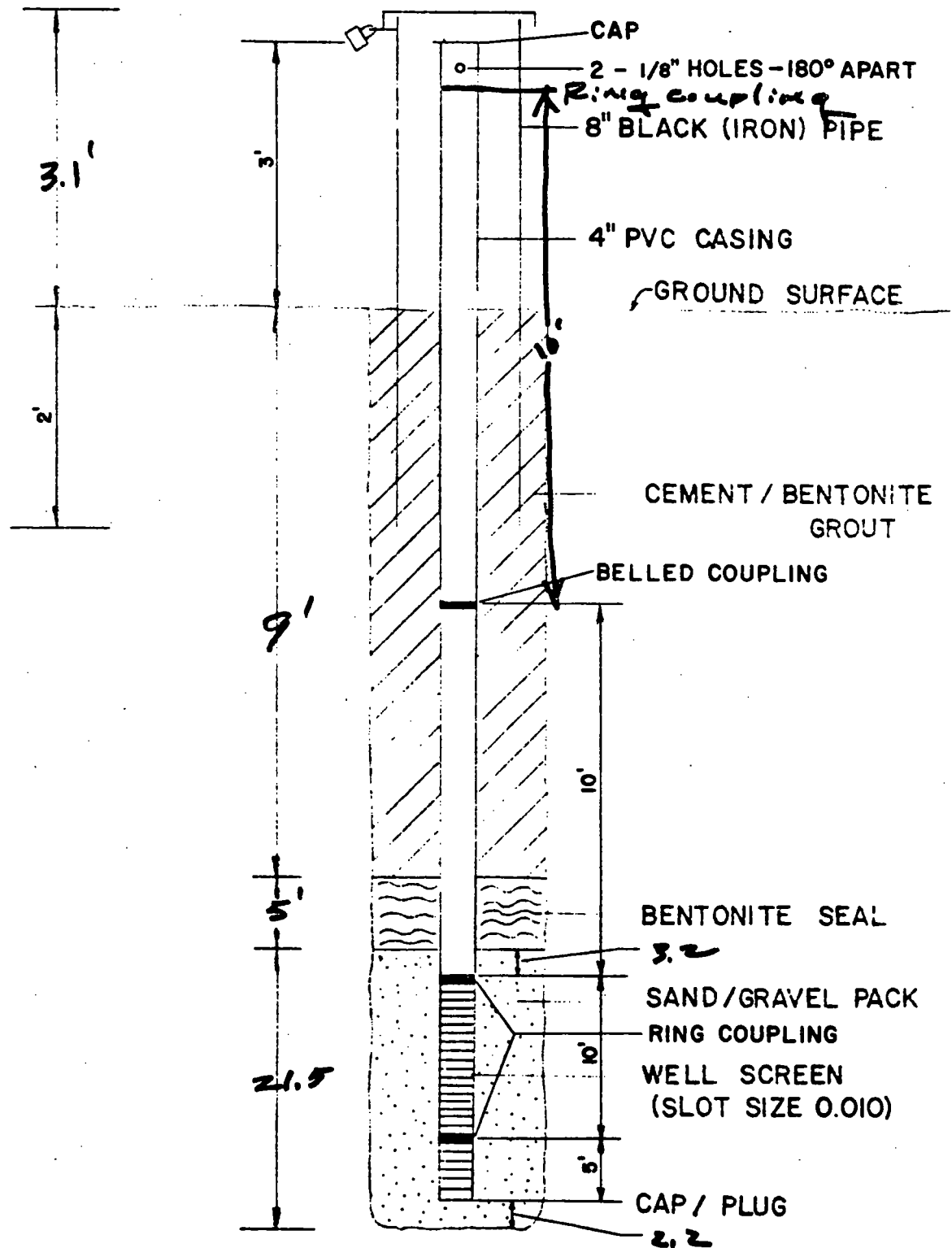
OVERALL LENGTH OF 4" P.V.C. 35.8

35.8
32.8
3.0

35.8
32.8
3.0

MONITOR WELL INSTALLATION

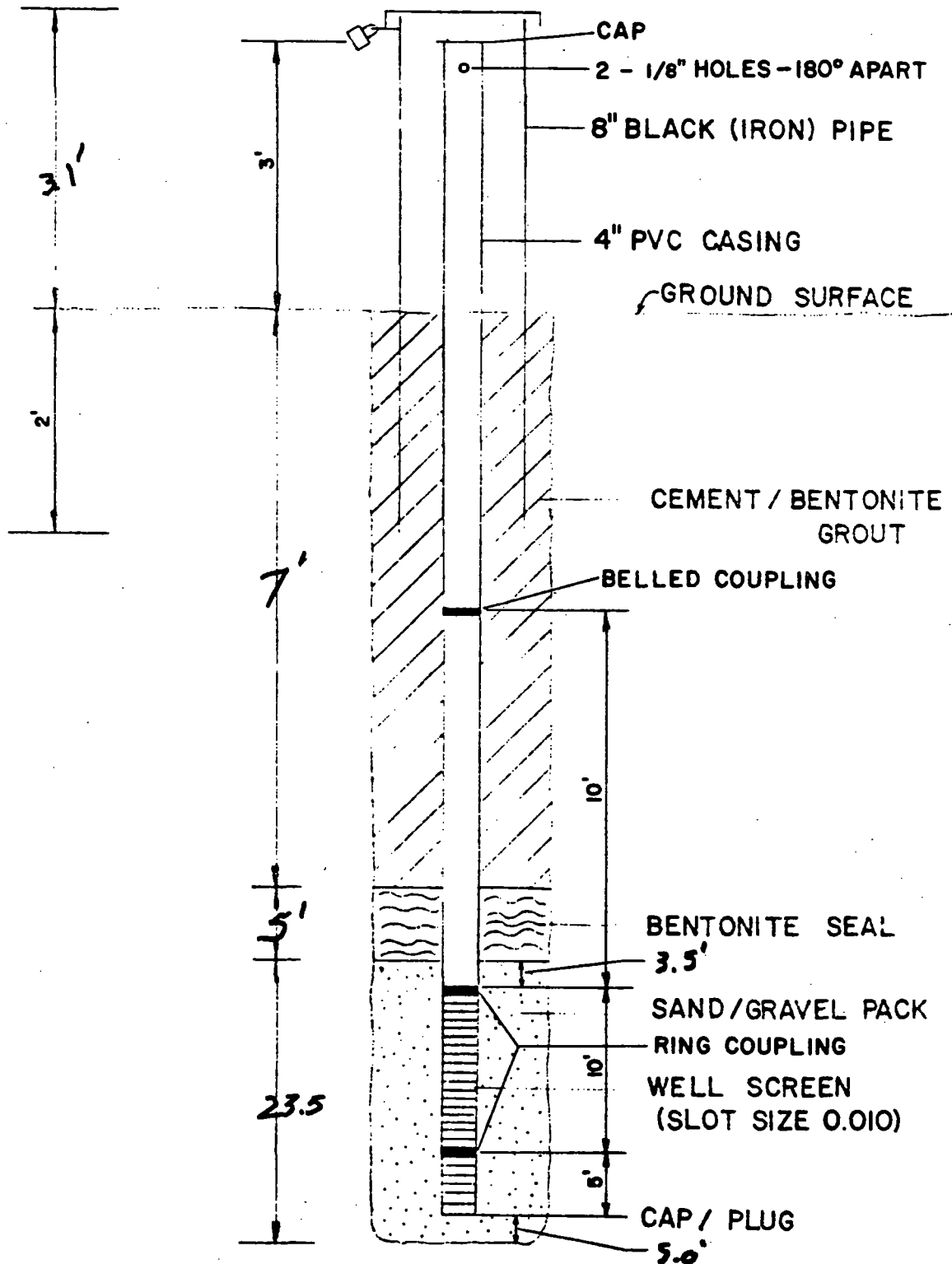
G-23



OVERALL LENGTH OF 4" P.V.C. 36.3

MONITOR WELL INSTALLATION

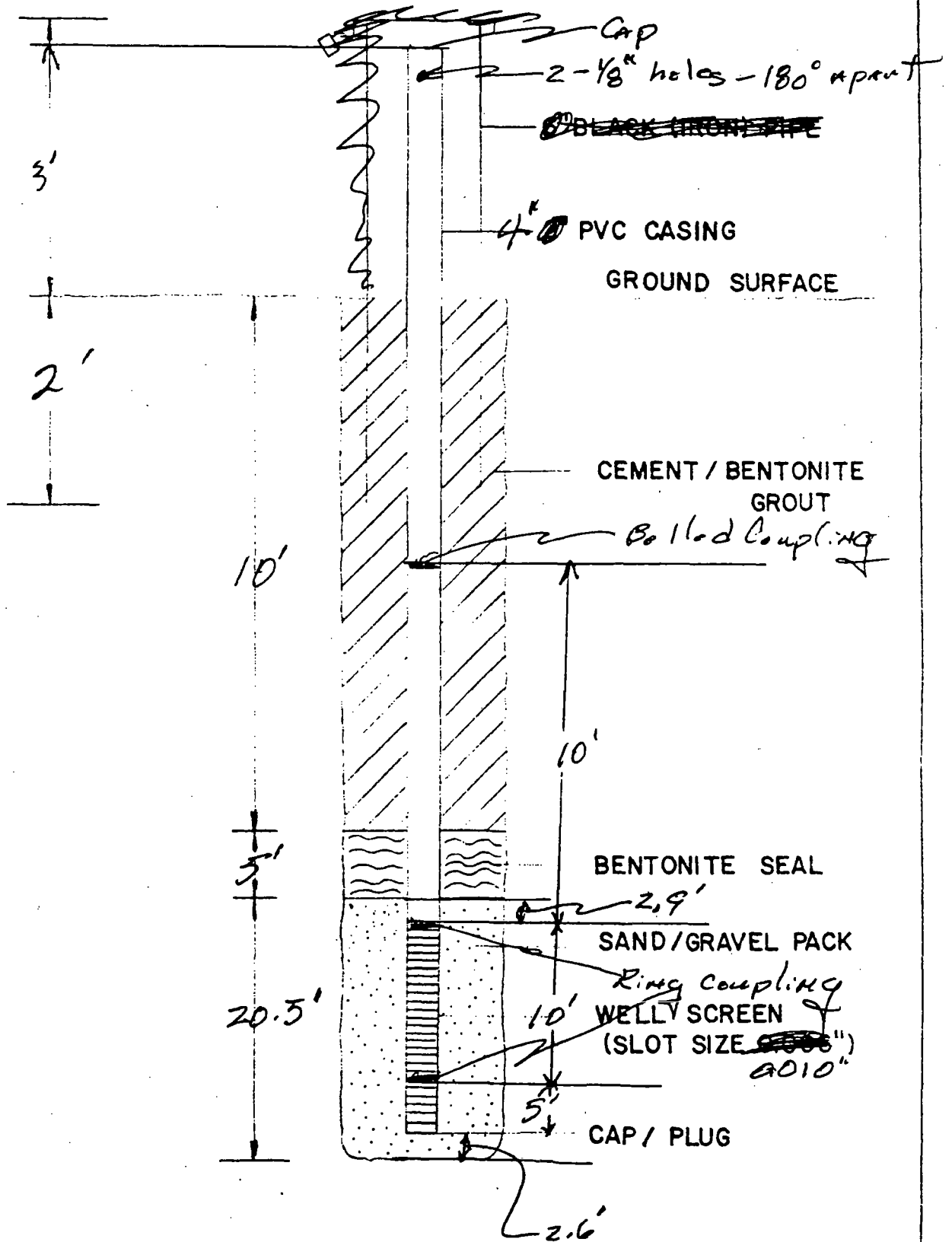
G-24



OVERALL LENGTH OF 4" P.V.C. **33.5'**

MONITOR WELL INSTALLATION

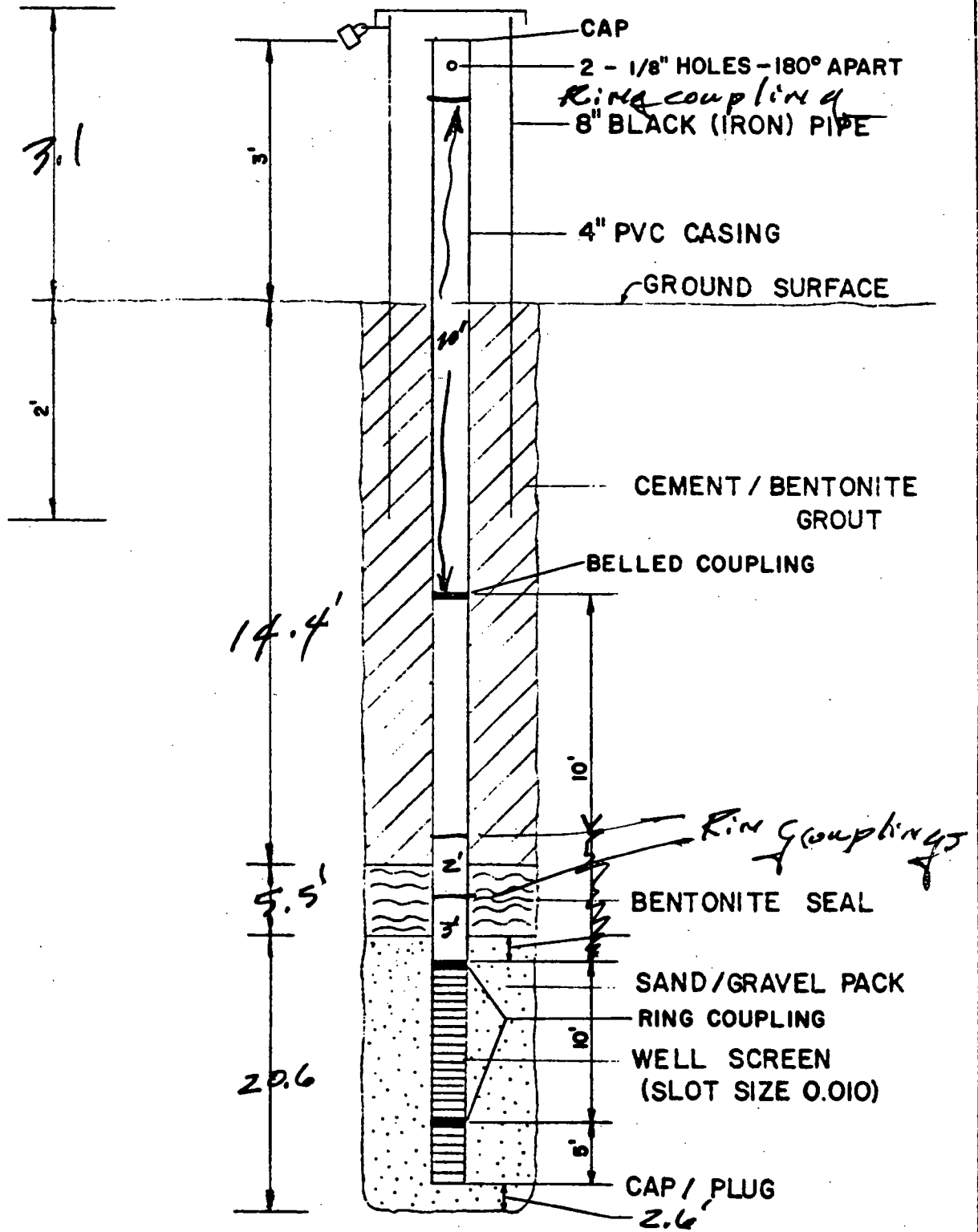
G-25



overall length of 4" PVC - 35.9'

MONITOR WELL INSTALLATION

G-26



OVERALL LENGTH OF 4" P.V.C.

40.9'

SOUTHWESTERN LABORATORIES

40.5
37.9
2.6

8
17.9
20.6

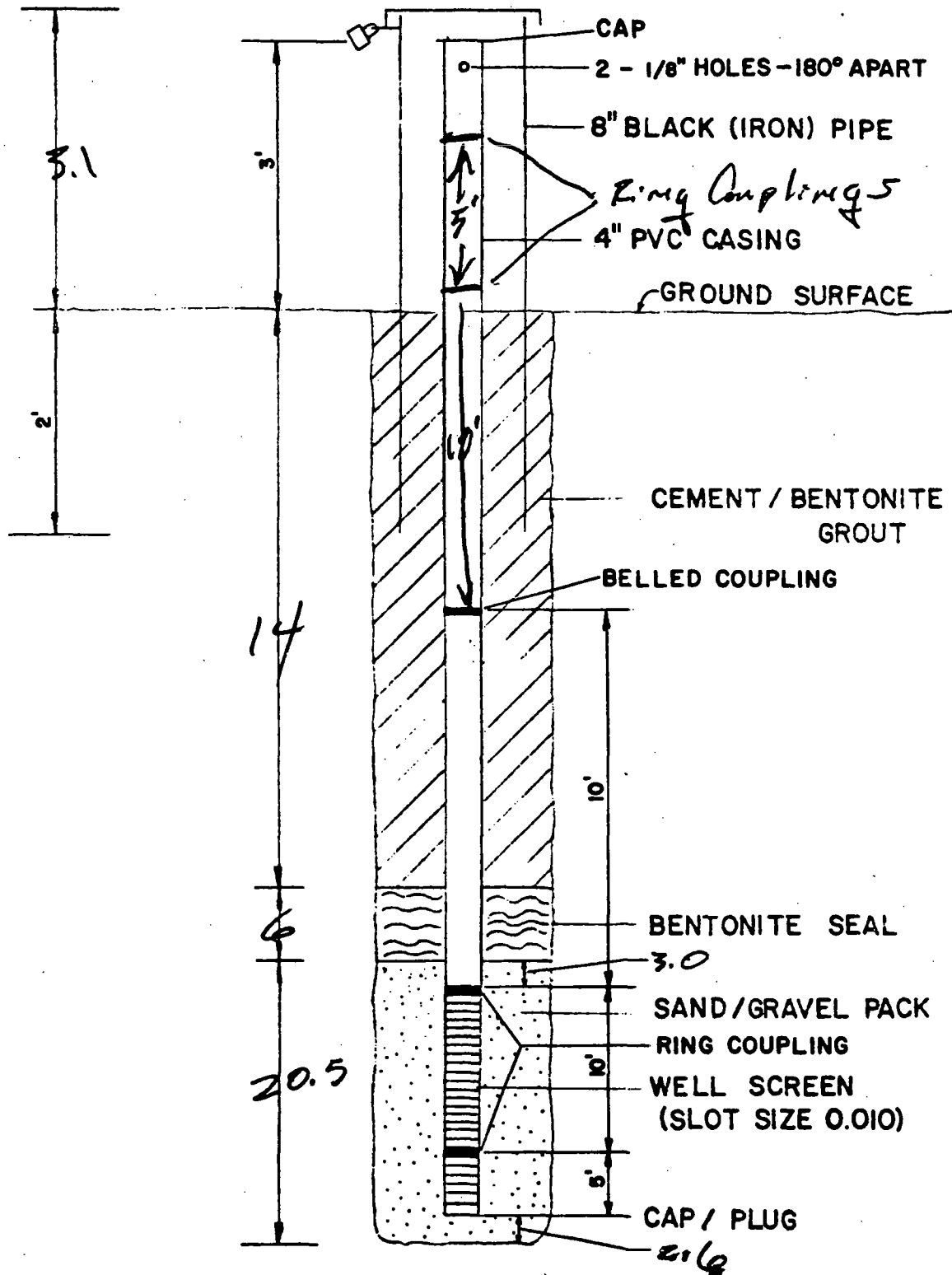
20.6
26.1
5.5

26.0

21.0

MONITOR WELL INSTALLATION

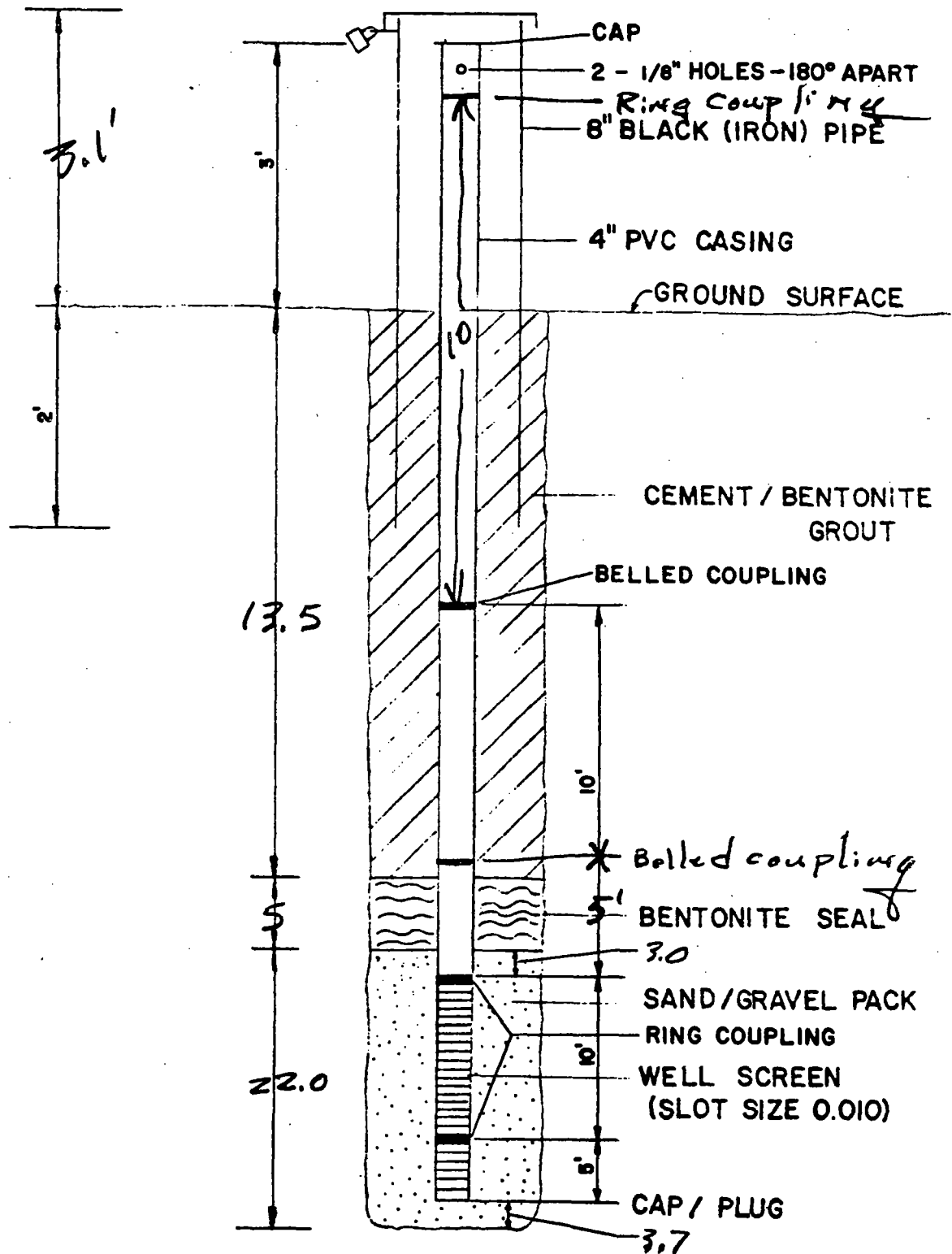
G-27



OVERALL LENGTH OF 4" P.V.C.

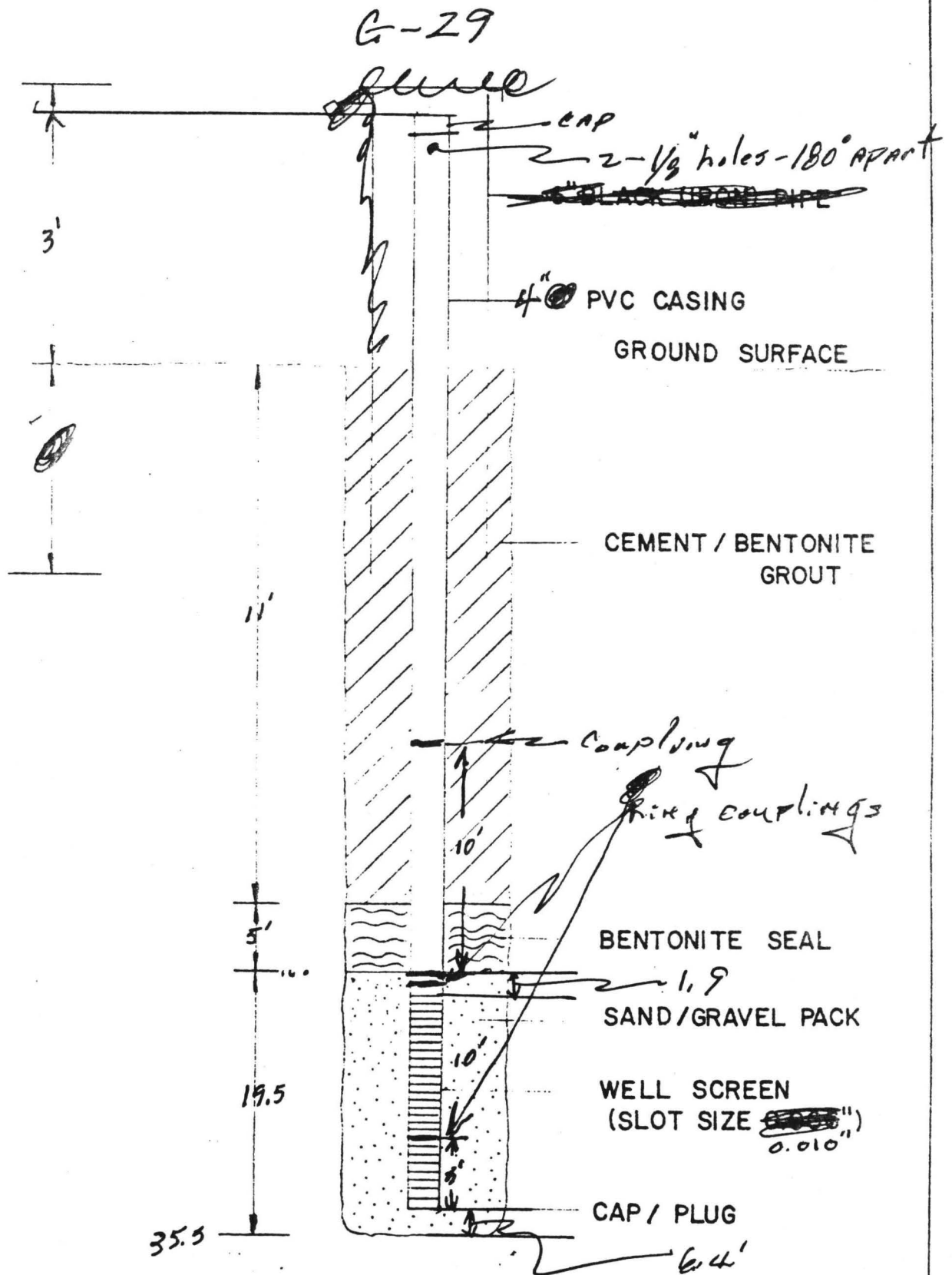
MONITOR WELL INSTALLATION

G-28



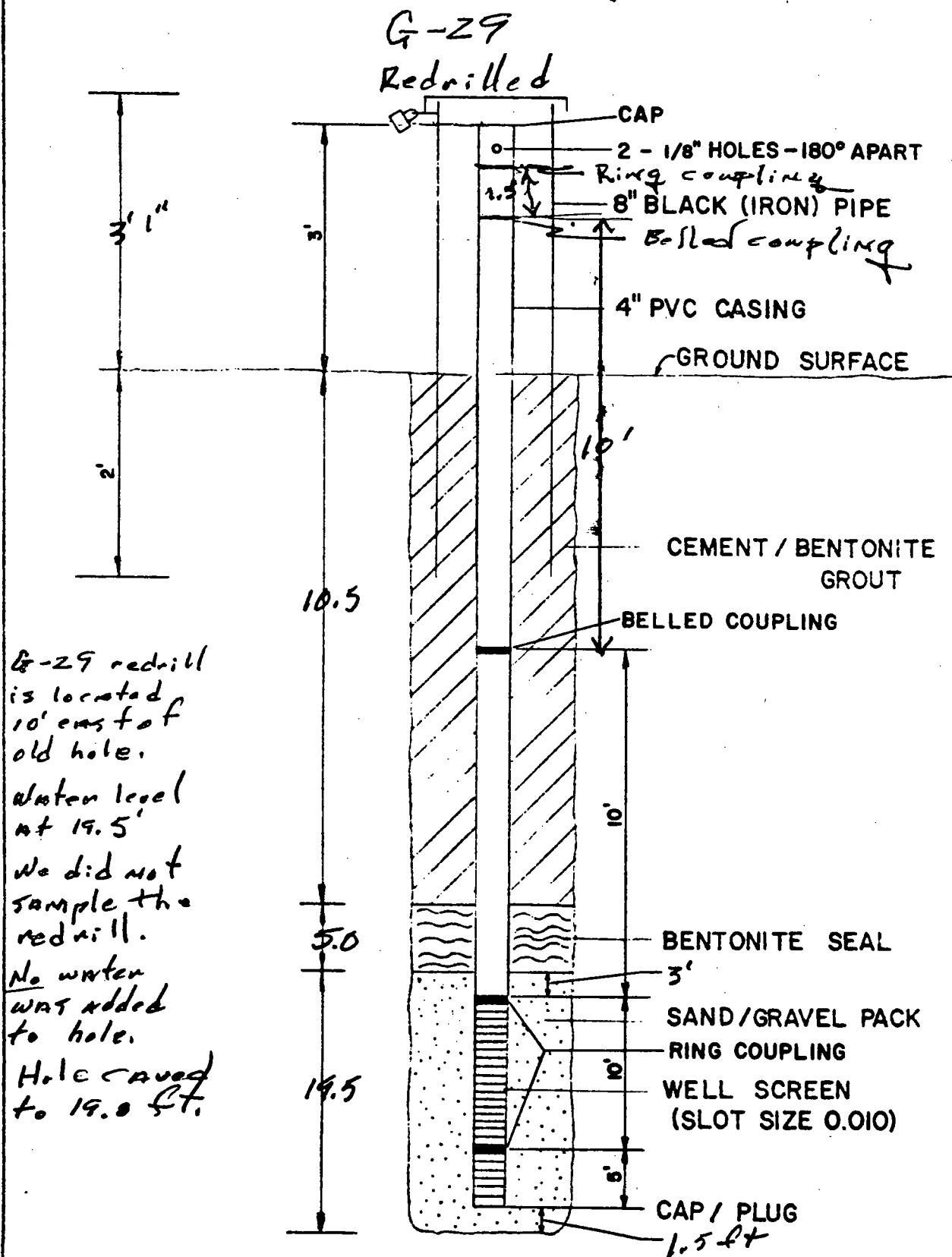
OVERALL LENGTH OF 4" P.V.C. 39.8

MONITOR WELL INSTALLATION



Overall length of 4" P.V.C. — 29.1

MONITOR WELL INSTALLATION

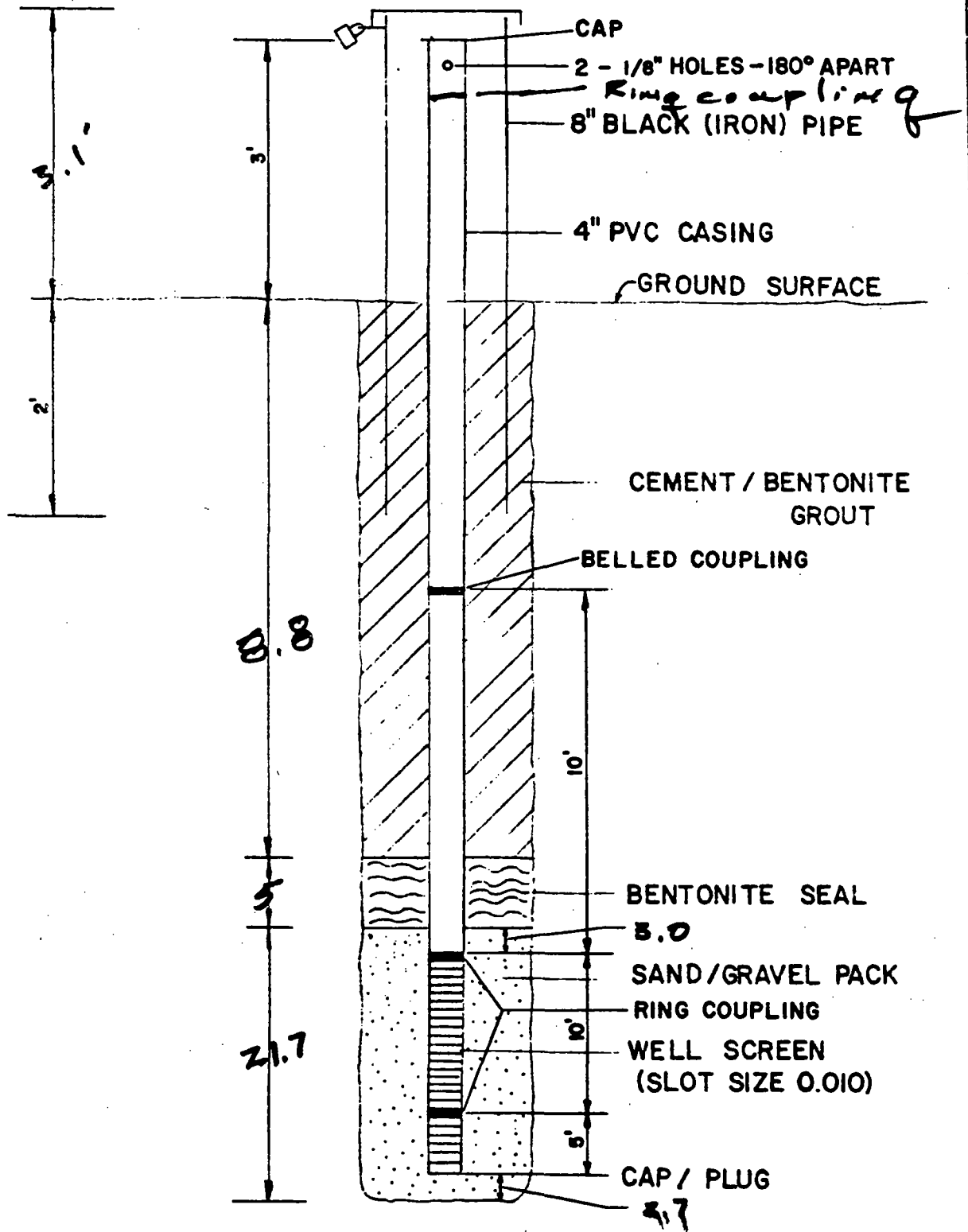


R. G. Smith

OVERALL LENGTH OF 4" P.V.C. - 36.5

MONITOR WELL INSTALLATION

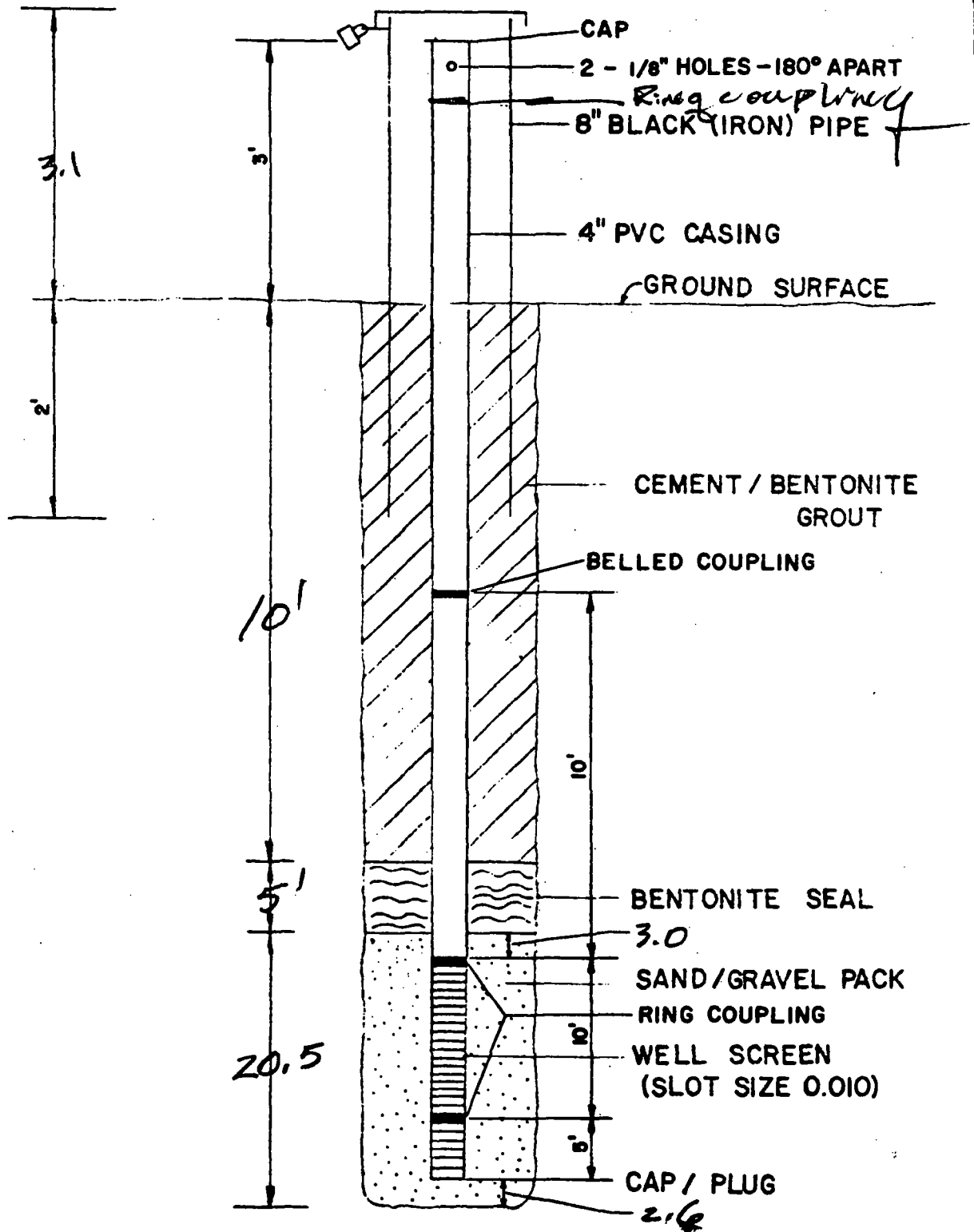
G-30



OVERALL LENGTH OF 4" P.V.C. 34.7

MONITOR WELL INSTALLATION

G-31



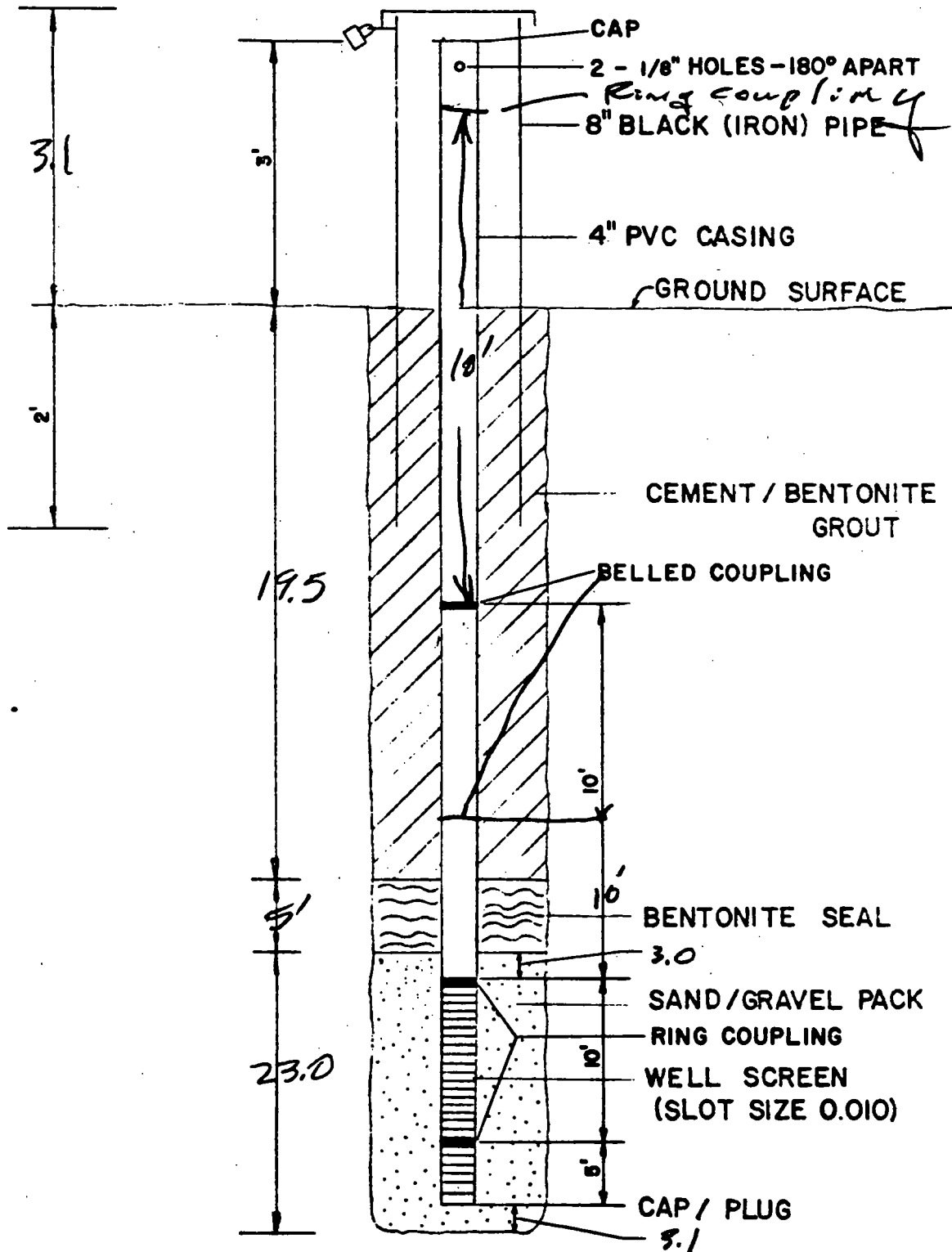
OVERALL LENGTH OF 4" P.V.C. 35.9

SOUTHWESTERN LABORATORIES

3.5
32.9
2.6

MONITOR WELL INSTALLATION

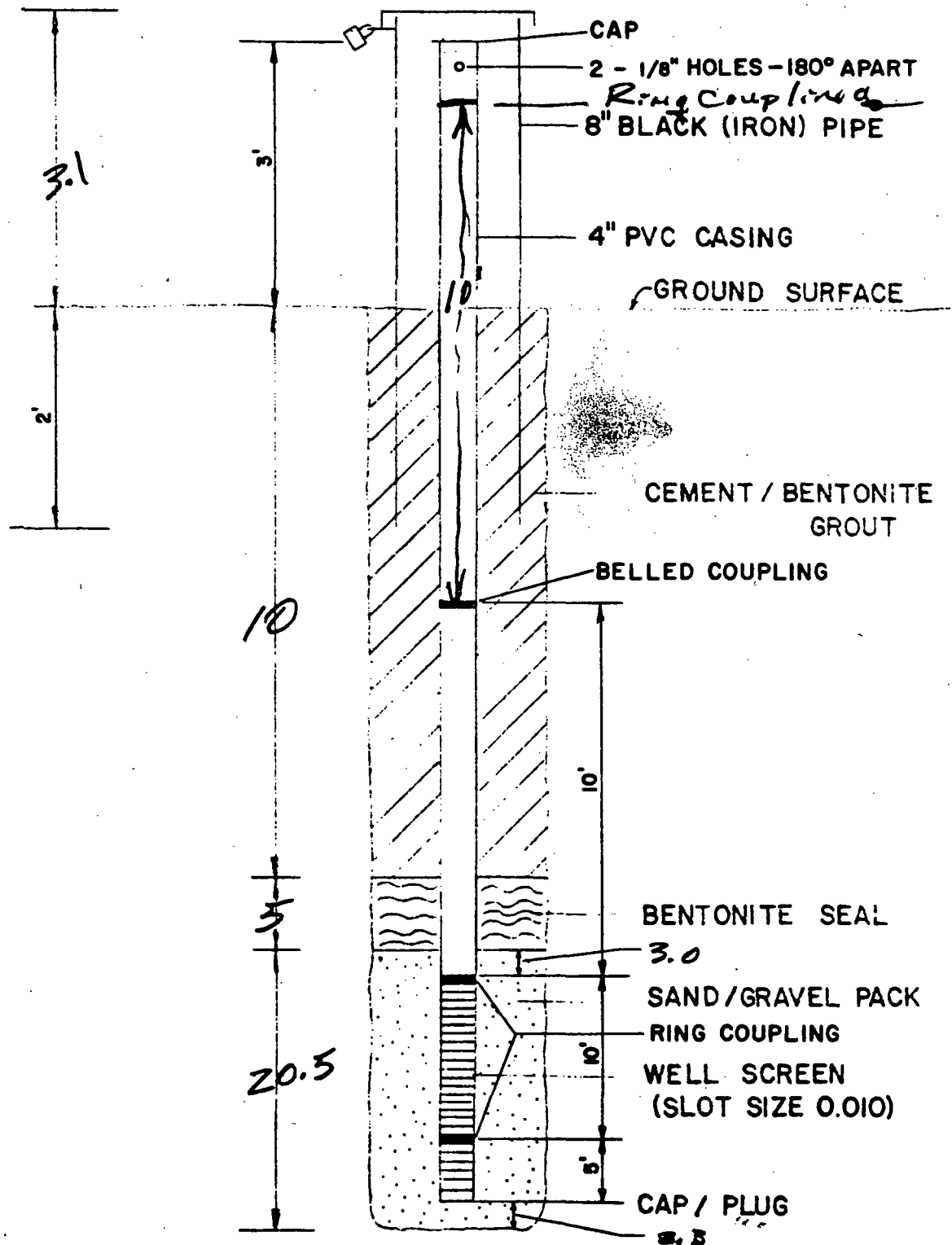
G-32



OVERALL LENGTH OF 4" P.V.C. 45.4

MONITOR WELL INSTALLATION

G-33



OVERALL LENGTH OF 4" P.V.C. 36.2

APPENDIX C
WELL DEVELOPMENT RECORDS

G-1	WELL DESIGNATION
Started pump at 1:40 pm Stop at 2:25 pm 11-9-81	DATE INSTALLATION
11-21-81	DATE DEVELOPMENT
18.0 (Top of P.U.C.)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
18.0 (")	
20 gals - 600 gals - 45 min.	WATER REMOVED and TIME
33.3' (Top of P.U.C.)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
33.3 (")	
Water very muddy at start. Began clearing up within 5 min and completely clear after 10 mins.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Very fine sand and silt, gray, quartz Small amount	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pump set at 2 ft. off bottom Pumping rate - 15/min.	TYPE AND SIZE OF PUMP



G-33	WELL DESIGNATION
12-6-81	DATE INSTALLATION
12-6-81	DATE DEVELOPMENT
Before 23.0 ft (6p P.C.)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 23.0 ft. "	
600 gal	WATER REMOVED and TIME
40 min	
Before 36.2 ft Top P.C.	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 36.2 ft. "	
Very muddy at start, light yellowish Brown Begin clearing after 5 min Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt. light yellowish Brown	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gal/min Pump set 30 ft off bottom.	TYPE AND SIZE OF PUMP

G-32	WELL DESIGNATION
12-7-81	DATE INSTALLATION
12-7-81	DATE DEVELOPMENT
Before 33.5 (Top P.V.C.) After 33.5 "	WATER LEVEL BEFORE and AFTER DEVELOPMENT
300 600 gals 20 40 mins	WATER REMOVED and TIME
Before 45.4 (Top P.V.C.) After 45.4 "	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Very muddy at start, light gray. Began clearing after 5 min. Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt light gray.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gal/min Pump set at 20' off bottom A.C. Smead	TYPE AND SIZE OF PUMP

G-31	WELL DESIGNATION
12-4-81	DATE INSTALLATION
12-4-81	DATE DEVELOPMENT
Before 20.8 (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 20.8 "	
600 gals	WATER REMOVED and TIME
40 mins	
Before 35.9 (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 35.9	
Very mudd at start, Light yellowish Brown Began clearing after 5 min Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt Light yellowish Brown	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate 15 gal/min Pump set at 3.0 ft off bottom.	TYPE AND SIZE OF PUMP


C-30	WELL DESIGNATION
12-4-81	DATE INSTALLATION
12-4-81	DATE DEVELOPMENT
Before 23.5 (Top PIC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 23.5 23.3 "	
600 gal	WATER REMOVED and TIME
40 min	
Before 34.07 (Top PIC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 34.07 (")	
Very muddy at start, light yellow Brown, Begin clearing after 5 min, Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of fine sand & silt Light yellowish Brown.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gal/min. R.C. Truck Pump it in 20 min.	TYPE AND SIZE OF PUMP

G-29	WELL DESIGNATION
11-25-81	DATE INSTALLATION
11-25-81	DATE DEVELOPMENT
Before 22.8' (Top P.C.)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 22.8 "	
80 cut - 600 gal	WATER REMOVED and TIME
Before 36.5' (Top P.V.C.)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 36.5 "	
Very muddy at start, Begin cleaning, after 5 mins, completely clear after 10 mins. water was light yellowish brown	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand silt, light yellowish brown	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gals/min Pump set 3.0 aft bottom	TYPE AND SIZE OF PUMP

G-28	WELL DESIGNATION
12-7-81	DATE INSTALLATION
12-7-81	DATE DEVELOPMENT
Before 24.8 (Top P.V.C.)	WATER LEVEL BEFORE
After 24.8 (")	and AFTER DEVELOPMENT
600 gal	WATER REMOVED
40 min	and TIME
Before 39.8 (Top P.V.C.)	DEPTH OF HOLE BEFORE
After 39.7 (")	and AFTER DEVELOPMENT
Very muddy at start, light gray Begin cleaning after 5 min Completely clear after 10 min	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt light gray	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gal/min Pump set 3.0 ft off bottom of well	TYPE AND SIZE OF PUMP

G-27	WELL DESIGNATION
12-6-81	DATE INSTALLATION
12-6-81	DATE DEVELOPMENT
Before 26.5 (Top PVC) After 26.5 "	WATER LEVEL BEFORE and AFTER DEVELOPMENT
600 gal 40 min.	WATER REMOVED and TIME
Before 40.9 (Top PVC) After 40.9 "	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Very muddy at start, light gray. Began clearing after 5 min. Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt light gray	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gals/min Pump set at 30 ft. off bottom.	TYPE AND SIZE OF PUMP

G-26	WELL DESIGNATION
12-5-81	DATE INSTALLATION
12-5-81	DATE DEVELOPMENT
Before 26.0 (Top PVC) After 26.0 "	WATER LEVEL BEFORE and AFTER DEVELOPMENT
600 gal 40 mins	WATER REMOVED and TIME
Before 40.9 (Top PVC) After 40.9 "	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Very muddy at start, light gray. Begin clearing within 5 min. Completely clearing after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt. light gray.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gals/min Pump set 20 ft. at bottom	TYPE AND SIZE OF PUMP

G-25	WELL DESIGNATION
11-7-81	DATE INSTALLATION
11-25-81	DATE DEVELOPMENT
Before 21.9 (Top PVC) After 21.9	WATER LEVEL BEFORE and AFTER DEVELOPMENT
80 cu ft - 600 gal 40 min	WATER REMOVED and TIME
Before 36.0 (Top PVC) After 36.0	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Very muddy at start, light yellowish brown. Began clearing after 5 min Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand and silt gray.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Rod Tracket - 1/2 hp. Pumping Rate - 15 gal/min. Pump Set at 3.0 ft off bottom 	TYPE AND SIZE OF PUMP

G-24	WELL DESIGNATION
12-3-81	DATE INSTALLATION
12-3-81	DATE DEVELOPMENT
Before 19.9' (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 20.0 "	
64 ft gal	WATER REMOVED and TIME
Before 33.5' (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 33.5 "	
Very muddy at start, light yellowish Brown Begin clearing after 5 min. Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt, Light yellowish Brown.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gal/min. Pump set at 3.0 ft below	TYPE AND SIZE OF PUMP

G-23		WELL DESIGNATION
12-2-81		DATE INSTALLATION
12-2-81		DATE DEVELOPMENT
Before 21.8 (Top PVC)		WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 21.8 "		
80 cu ft - 600 gal		WATER REMOVED and TIME
40 min		
Before 36.3 (Top PVC)		DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After "		
very Muddy at start, light yellowish brown Began clearing after 5 min. Completely clear after 10 min. Sample has a yellowish cast.		PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt Light yellowish brown.		PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 hp Pumping rate - Pump set at 30 ft off bottom		TYPE AND SIZE OF PUMP

R. D. Duneau

G 22	WELL DESIGNATION
12.2.81	DATE INSTALLATION
12.2.81	DATE DEVELOPMENT
Before 20.5 (Top PVC) After 20.3 (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
80 cu ft - 600 gals 40 min.	WATER REMOVED and TIME
Before 35.8 (Top PVC) After 35.3 "	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Very muddy at start light yellowish brown start to clear after 5 min. Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt light yellowish brown.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Rod & bucket - 1/2 hr Pumping rate - 15 gal/min. Pump set at 3.0 ft off bottom R. B. Bland	TYPE AND SIZE OF PUMP


G-21	WELL DESIGNATION
11-28-81	DATE INSTALLATION
11-28-81	DATE DEVELOPMENT
Before 20.0 (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 20.0 "	
80 cu ft - 600 gals	WATER REMOVED and TIME
40 min.	
Before 36.5 (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 36.5 "	
Very muddy at start, light yellowish brown. Begin to clear after 5 min. Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt, light yellowish brown	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gal/min Pump set at 2.0 ft off bottom.	TYPE AND SIZE OF PUMP

G-20	WELL DESIGNATION
11-28-81	DATE INSTALLATION
11-28-81	DATE DEVELOPMENT
Before 27.5 (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 27.5 "	
30 min - 600 gal	WATER REMOVED and TIME
40 min	
Before 35.0 (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 35.0 "	
Very maddy at start light gray. Started to clear after 3 min. Completely clear after 5 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt, gray.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket, - 1/2 h.p. Pumping rate - 15 gal/min. Pump set 3.0 ft. off bottom.	TYPE AND SIZE OF PUMP

G19	WELL DESIGNATION
11, 27, 81	DATE INSTALLATION
11, 27, 81	DATE DEVELOPMENT
Before: 22' Top P.V.C	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After: 22' " "	
80 cu ft - 600 gals 40 min	WATER REMOVED and TIME
Before 35.3 Top P.V.C	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 35.3 " "	
very muddy at starting, begin to clear after 5 min. completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
yellowish brown fine sand with silt	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket, 1/2 HP Rate of pumping 15 gpm pump set 20 ft bottom	TYPE AND SIZE OF PUMP

G18	WELL DESIGNATION
11, 27, 81	DATE INSTALLATION
11, 27, 81	DATE DEVELOPMENT
Before 21.5' Top of P.V.C	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 21.5 "	
80 cu ft - 600 gal 40 min	WATER REMOVED and TIME
Before: 36' Top of P.V.C	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 36' "	
very muddy at start, light yellowish brown begin to clear after 5 min. smother completely clear after 15 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of var/ fine sand & silt light yellowish brown.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket. $\frac{1}{2}$ HP pumping rate 15 gpm. pump set 3' off the bottom	TYPE AND SIZE OF PUMP

G-17	WELL DESIGNATION
11-7-81	DATE INSTALLATION
11-24-81	DATE DEVELOPMENT
Before 21.8' (Top P.V.C.) After 21.8' (")	WATER LEVEL BEFORE and AFTER DEVELOPMENT
80 cu ft 600 gals 40 min	WATER REMOVED and TIME
Before 33.9' (Top P.V.C.) After 33.9 " "	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Slightly muddy at start, light yellowish brown Becoming completely clear after 5 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Very small amount of very fine sand & silt, gray	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gals/min Pump set 30 ft above bottom	TYPE AND SIZE OF PUMP



G-16	WELL DESIGNATION
11-6-81	DATE INSTALLATION
11-25-81	DATE DEVELOPMENT
Before 23.9' (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 23.5 "	
80 cu ft - 600 gal 40 min.	WATER REMOVED and TIME
Before 32.3' (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 32.3' "	
Very maddy at start, light yellow brown. Again clearing after 5 min. Completely clean after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt, gray	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping Rate - 15 gal/min Pump set 3.0 off bottom	TYPE AND SIZE OF PUMP

Robert L. [Signature]

G-15	WELL DESIGNATION
11-26-81	DATE INSTALLATION
11-26-81	DATE DEVELOPMENT
Before 22.0' (Top P.C.) After 22.0' "	WATER LEVEL BEFORE and AFTER DEVELOPMENT
80 well - 600 gal 40 mins	WATER REMOVED and TIME
Before 35.0' (Top P.C.) After 35.0' (")	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Very muddy at start, light yellowish Brown Began clearing after 5 mins. Completely clear after 10 mins.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt, gray	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Rod Tracket - 1/2 h.p. Pumping rate - 15 gals/min Pump set at 20 ft off bottom	TYPE AND SIZE OF PUMP

G-14	WELL DESIGNATION
11-26-81	DATE INSTALLATION
11-26-81	DATE DEVELOPMENT
Before 20.0 (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 24.0 "	
250 gals	WATER REMOVED and TIME
50 mins	
Before 35.3 (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 35.3 (Top PVC)	
Very muddy at start, light yellowish brown, started clearing within 2 mins. Completely clear after 5 mins.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of gray, very fine sand and silt.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping Rate - 5.0 gals/min. Pump set 3.0 ft off bottom.	TYPE AND SIZE OF PUMP

G-13	WELL DESIGNATION
11-14-81	DATE INSTALLATION
11-24-81	DATE DEVELOPMENT
Before 21.3' (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 21.3' "	
80 cu ft - 600 gals 40 min	WATER REMOVED and TIME
Before 36.3' (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 36.3' "	
Slightly muddy at start, light yellowish brown After 5 min completely clear.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
A very small amount of very fine sand & silt, gray	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 hp. Pumping Rate - 15 gals/min Pump set 30 ft off bottom <i>Robert M. Muel</i>	TYPE AND SIZE OF PUMP

G-12	WELL DESIGNATION
11-13-81	DATE INSTALLATION
11-23-81	DATE DEVELOPMENT
20.5' (Top P.V.C)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
20.5' "	
80 cu ft. - 600 gals	WATER REMOVED and TIME
40 min	
31.3' (Top P.V.C)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
31.3' "	
Very muddy at start. Began to clear after 5 min. Completely clear after 10 min	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt, gray, quartz	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Tractor - 1/2 hp. Pumping Rate - 15 gals/min Pump set at 3.0' off bottom	TYPE AND SIZE OF PUMP

Robert L. Murrell

G-11	WELL DESIGNATION
11-13-81	DATE INSTALLATION
11-23-81	DATE DEVELOPMENT
19.5' (Top PUC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
19.0 "	
20 wet - 600 gals 40 min	WATER REMOVED and TIME
30.3' (Top PUC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
31.3' "	
Water slightly muddy at start. Completely clear after 5 mins.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Very small amount of very fine sand and silt, gray, quartz	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gal/min Pump set 2.0 ft off bottom	TYPE AND SIZE OF PUMP

Robert H. [Signature]

G-10	WELL DESIGNATION
11-8-81	DATE INSTALLATION
11-24-81	DATE DEVELOPMENT
Before 17.3' (Top P.V.C.) after 17.7 "	WATER LEVEL BEFORE and AFTER DEVELOPMENT
80 cu ft. — 600 gal 40 min.	WATER REMOVED and TIME
Before 30.7 (Top P.V.C.) After 30.7 "	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Very muddy at start, yellowish brown. Began clearing after 5 min. Completely after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small Small amount of light yellow brown, very fine sand and silt.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Tractor — 1/2 h.p. Pumping rate 13 gals/min Pump set 3.0 ft bottom	TYPE AND SIZE OF PUMP

Robert L. [Signature]

G-9	WELL DESIGNATION
11-12-81	DATE INSTALLATION
11-24-81	DATE DEVELOPMENT
Before 19.5' (Top PUC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After "	
80 cu ft. - 600 gals	WATER REMOVED and TIME
40 min	
Before 31.6' (Top PUC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After "	
Very muddy at start, light yellowish Brown, After 5 min it started clear. Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of light yellowish Brown, very fine sand and silt.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate Pump set 3.0 cu ft/min	TYPE AND SIZE OF PUMP

[Signature]

G-8	WELL DESIGNATION
11-11-81	DATE INSTALLATION
11-22-81	DATE DEVELOPMENT
Before 18.7' (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 19.0' (Top PVC)	
Start 12:25 pm Stop 1:15 pm	WATER REMOVED and TIME
80 cu ft - 600 gals 40 mins.	
Before 36.2' (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 36.2' (Top PVC)	
Very muddy at start. Began clearing after 5 min Completely clear after 10 min	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Very small amount of very fine sand and silt, gray, quartz	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 hp. Pumping rate - 15 gal/min Pump set at 20' at bottom	TYPE AND SIZE OF PUMP

Robert L. Reed

G-07	WELL DESIGNATION
11-13-81	DATE INSTALLATION
11-22-81	DATE DEVELOPMENT
Before 17.8' (Top P.V.C.) After 17.8' (Top P.V.C.)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
80 cu.ft. - 600 gals 40 min	WATER REMOVED and TIME
Start 11:25 am Stop 12:15	
Before 30.0' (Top P.V.C.) After 30.0' (Top P.V.C.)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Very muddy at start. Began clearing after 5 min. Completely clear after 10 min	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Very small amount of very fine sand & silt, gray, quartz	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate - 15 gals/min Pump set at 3.0 ft bottom	TYPE AND SIZE OF PUMP

Robert L. Trench

G-6	WELL DESIGNATION
Start 2:40 p.m. Stop 3:25 p.m.	DATE INSTALLATION
11-10-81	DATE DEVELOPMENT
11-21-81	WATER LEVEL BEFORE and AFTER DEVELOPMENT
17.5 (Top of POC)	
17.5 "	
80 cu. ft. - 600 gals - 45 min.	WATER REMOVED and TIME
1	
30.3' (Top of P.V.C)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
30.3 "	
Water very muddy at start. Began clearing after 5 min. and completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand and silt, gray, quartz	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 hp. Pump set 3 ft. off bottom Pumping water - 15 gals/min.	TYPE AND SIZE OF PUMP

Robert L. Truesdell

G-5	WELL DESIGNATION
4-10-81	DATE INSTALLATION
Started Pumping at 3:25 pm. - Stop - 4:05 pm.	DATE DEVELOPMENT
11-20-81	DATE DEVELOPMENT
19.0'	WATER LEVEL BEFORE and AFTER DEVELOPMENT
19.2'	WATER LEVEL BEFORE and AFTER DEVELOPMENT
80 cu ft - 600 gal	WATER REMOVED and TIME
30.8'	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
30.3'	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
Water very muddy at start. Began to clear up w/in 5 min after development started. Water was clear after 10 min of pumping	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Very fine sand and silt, gray, quartz Small amount.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Rod Jacket - 1/2 h.p. Pump set 3.0 ft off bottom Robert L. Truitt Pumping water in well for 10 min.	TYPE AND SIZE OF PUMP

G-4	WELL DESIGNATION
11-9-81	DATE INSTALLATION
11-24-81	DATE DEVELOPMENT
Before 20.0' (Top P.U.C.)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 20.0' "	
80 cu ft - 600 gals	WATER REMOVED and TIME
40 min.	
Before 35.4 (Top P.U.C.)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 35.4 "	
Very Muddy at start, light yellowish brown. Began clearing after 5 min. Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of light yellowish brown, very fine sand and silt.	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 hp. Pumping rate 15 gals/min Pump set 20.0' with	TYPE AND SIZE OF PUMP

G-3	WELL DESIGNATION
11-12-81	DATE INSTALLATION
11-22-81	DATE DEVELOPMENT
Before 18.3' (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 19.0' (Top PVC)	
80 Cu ft - 600 gals	WATER REMOVED and TIME
40 min.	
Before 29.9' (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 29.5' (Top PVC)	
Very muddy at start. Begin clearing after 1 min Completely clear after 1 min	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Very small amount of very fine sand & silt, gray, quartz	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket - 1/2 h.p. Pumping rate 15. gals/min Pump set 2 ft below bottom	TYPE AND SIZE OF PUMP

C-2 redwell	WELL DESIGNATION
12-8-81	DATE INSTALLATION
12-8-81	DATE DEVELOPMENT
Before 18.0 ft (Top PVC)	WATER LEVEL BEFORE and AFTER DEVELOPMENT
After 18.0 ft (Top PVC)	
450 gal 30 min	WATER REMOVED and TIME
Before 39.5 ft (Top PVC)	DEPTH OF HOLE BEFORE and AFTER DEVELOPMENT
After 39.5 ft	
Very muddy at start, light gray) Beginning clearing after 5 min. Completely clear after 10 min.	PHYSICAL CHARACTER OF WATER (clarity, color, particulates, and odor)
Small amount of very fine sand & silt. light gray	PHYSICAL CHARACTER OF SEDIMENTS (lithology, and grain size)
Red Jacket — 1/2 hp. Pumping rate — 15 gals/min. Pump set 3.0 ft off bottom.	TYPE AND SIZE OF PUMP